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FOOD MANUFACTURE

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Volume . . . IX
Number . . . 6

JUNE . . 1934

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SUBSCRIPTION

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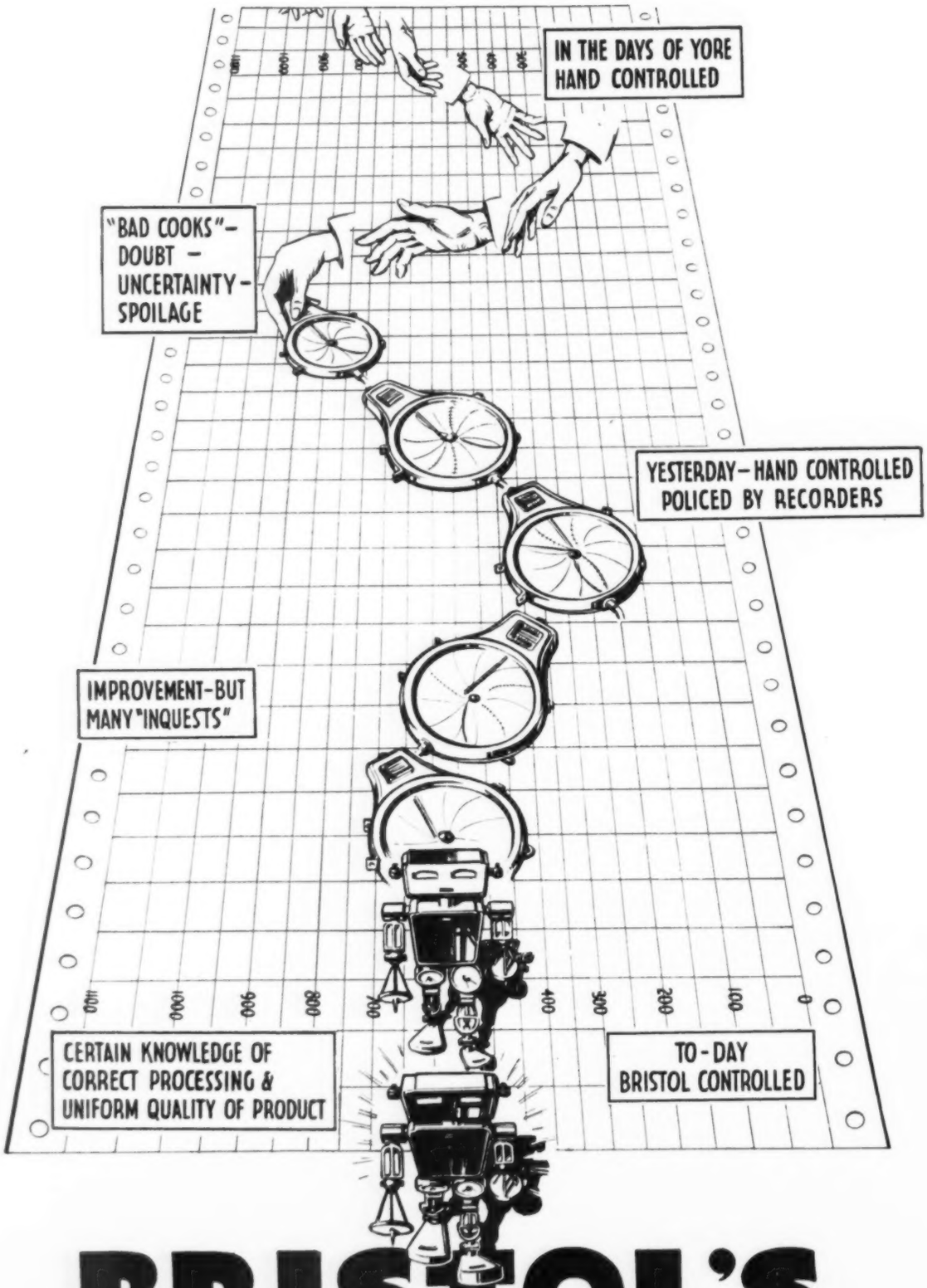
The Editor will be glad to consider contributions from those engaged in the Food Industry. Articles intended for publication should be of a practical nature and accompanied by photographs or drawings when possible.



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FOOD MANUFACTURE

Vol. IX., No. 6 **June, 1934**

The Food Report

LAST MONTH we made brief reference to the Report of the Departmental Committee on the Composition and Description of Food. The text of the Report was not then available, but we pointed out the complexity and delicacy of the situation, and urged that each case should be treated on its own individual merits. The Report has now been published, and from the food manufacturer's point of view it appears to be a very satisfactory document. The Committee have not been alarmed by the clamourings of certain witnesses to set up a Statutory Advisory Committee consisting of representatives of the Ministry of Health, public analysts, manufacturers and consumers. Such a body would be cumbersome and full agreement would be difficult to obtain; moreover, at the Ministry of Health there are already sufficient facilities to deal with any relevant matters, and their laboratory staff are continually guarding the consumers' rights. No good can possibly accrue from a multitude of committees. Action is required rather than talk, and the Ministry of Health is equipped materially and authorised legally to act. Let it do so. The Committee feel that the housewife generally gets what she asks for and that a multitude of standards and definitions would confuse rather than help her. Only in such cases where definitions are desirable for the protection of public health is it suggested to take any action.

It is pleasing to note that after careful consideration and after sifting out much evidence, to judge from the tone of the Report, the Committee have satisfied themselves as to the integrity of the British food manufacturer and the quality of his products.

The Sawfly Appears

During April and May the apple sawfly, whose real name, *Hoplocampa testudinea* Klug, is almost as terrible as its ravages, emerges from its winter quarters and attacks the apple trees when they are in blossom. During most of the year, from July to April, it lies dormant in the soil, but its three months of activity are crowded with incident and cause much worry to apple growers.

The fly lays its eggs in the calyx region of the flower just below the petals. The *modus operandi* of this operation is very interesting. The insect selects a flower, stands firmly on it and inserts a pair of saws, that are concealed in the abdomen, into the flower receptacle, making a penetrating incision that passes inwards and upwards. The egg is passed along the incision and placed close to the bases of the stamens well into the calyx cup. When the egg hatches, the caterpillar tunnels into the fruit to feed. Sometimes a caterpillar will enter three fruits before reaching maturity, and often every apple on a tree is destroyed. Last season this was the cause of the scarcity of Worcester Permains, which were badly attacked.

The Remedy

Effective control is possible. Investigations at Manchester University showed that the egg was partly exposed towards the end of the incubation period, and, after hatching, the caterpillar left the calyx to attack the apple. It is at this time that it must be attacked by sprays. It has been found that the best wash is 8 oz. nicotine per 100 gal. water. Two sprays should be given, the first just after petals fall, the second a week later. The investigations at Manchester showed that certain varieties such as Worcester Permain, James Grieve, Newton Wonder, and Beauty of Bath are highly susceptible to attack and require special attention.

Marketing of Fat Stock

The Report of the Fat Stock Commission is very interesting. It presents a useful survey of the

nation's meat supplies, and offers some sound suggestions for improving the production and marketing of fat stock. There is, however, disappointment among farmers that the Commission did not tackle the fundamental problem of prices in a more determined spirit. Of course there are two viewpoints on the question of marketing boards. The farmer sees in them primarily a means of protection from low-priced imports and therefore better prices for his products. The official view, however, considers that the reorganisation of marketing as contemplated in the original act of 1931 should of itself enable the home farmer to compete more satisfactorily with overseas producers.

Prices

The Commission's terms of reference were to prepare a scheme for regulating the marketing of fat stock, and no mention was made about obtaining remunerative prices for home producers. The graziers, however, argue that any marketing scheme must provide a fair price. They hoped that the Commission would recognise this by including in their recommendations details of a levy on imported meat to be used in the same way as the levy on flour under the Wheat Act to guarantee the home producer a standard price. Actually the report does commend this plan to the Government, but only if the stricter enforcement of import quotas does not bring better prices for the home producer. But the producer must not restrict consumption by increasing prices beyond the means of the consumers. An increased price can easily be neutralised by a decreased market, and that consideration probably accounts for the Commission's caution.

Safer Milk

In our Editorial Notes last month under the above heading we referred to the Memorandum issued by seven scientific authorities to the Government on the question of surplus milk and safe milk. This has led to some enquiries as to where this memorandum was published. In case other readers wish to consult the memorandum, which is interesting and important, they should refer to the *Lancet* of April 7, 1934, on page 757.

As was pointed out last month, the seven scientists who signed the document have outlined a milk policy based on scientific principles. Unlike many criticisms of the Government's Milk Policy, this is, at any rate, constructive, and if adopted it would probably secure the support of medical, veterinary, and agricultural interests. Its main plea is pasteurisation coupled with the establishment of tuberculin tested herds. This has evoked the time-worn complaint that pasteurisation diminishes the nutritive value of milk. To that we can only quote the work of J. C. Drummond (*J. Soc. Chem. Ind.*, 1933, vol. 52, p. 400 T), who carried out a series of experiments on young rats with raw and commercially pasteurised milk. These tests failed to detect any evidence that pasteurisation adversely affects the nutritive value of milk. The balance of evidence goes to prove that pasteurisation is advisable on the grounds of public health and if, as Drummond seems to have proved, it does not reduce its nutritive value, we agree with the Memorandum and believe that the Government ought to adopt the principles enumerated therein without delay.

Dysentery and Food Handlers

There has recently been published a report of a committee appointed to investigate the outbreak of dysentery in Chicago last year. The committee is convinced that the infection was amœbic. Two hotels were concerned, and as soon as the dysentery was reported steps were taken to examine their food handlers. This investigation disclosed fifteen clinical cases and eleven carriers of *Entamœba histolytica*. A similar outbreak in Chicago in 1926-1927 was brought to an end by the exclusion of carriers from food service, and the same procedure was adopted in the present case, but without avail. The direct issue here has turned out to be one of engineering and plumbing and not of food handling, for food handlers were conspicuous victims and not originators of the epidemic. Nevertheless, the committee has rightly raised the question of carriers and food handling. It holds that no one passing cysts should be allowed to hold that occupation until seven days after treatment, and there have been three negative stool examinations, at intervals of at least one day, and at least four more at intervals of a month. The tracking down of all carriers among food handlers is not an easy matter, and there is room for considerable improvement in technique. Still, it is a serious matter, and one that should be thoroughly investigated.

Fruit Jellies

Most readers will be familiar with the researches which have been carried out during the past few

years by the Department of Chemistry at the Delaware Agricultural Experiment Station on pectin and fruit jellies. An excellent summary of the work has been given by Morris in his book on Fruit Preservation.

Seven bulletins have already appeared; now we have the eighth, compiled by P. B. Myers and G. L. Baker, dealing with the physico-chemical properties of pectin.

In the first four bulletins was studied the influence of acidity, sugar, and salts on jelly formation; the other three dealt with the rôle of pectin in jelly formation and the various factors that influence its extraction from pectic materials.

Pectin

Bulletin No. 7 was particularly interesting in that it examined the effect of temperature, *p*H, and time of heating on the extraction of pectin. It was stated that the pectins produced during this investigation included some that had the highest jellying power of any hitherto recorded in the literature.

The latest bulletin, No. 8, will appeal especially to those having an intimate knowledge of the chemistry of pectin. It is stated that pectin in the unhydrolysed condition is monoarabino-monogalacto-diacetyl-heptamethoxyl-octagalacturonic acid, and its probable empirical formula is $C_{70}H_{98}O_{58}$, with a molecular weight of 1867.

The jellying power of a pectin product is attributed to the degree of polymerisation of the galacturonic acid. No single constituent of the pectin molecule is a criterion of its jellying power.

Contrary to the general belief, the methoxyl content of pectins is not a measure of their jellying power. The methoxyl content may be lowered to a considerable extent without any appreciable decrease in jelly power.

Pectins of high jellying power, when stored, even under dry conditions, gradually decrease in jellying power.

Clarification of Vinegars

The clarification of vinegar, as applied particularly to wine and cider vinegars, has been discussed by L. G. Saywell. In these types of vinegars clouding may occur on short or long standing, even though they may have been previously clarified and rendered sterile. This cloudiness is associated with colloidal substances such as proteins, tannin, and pectin, as well as the iron content. Several methods for clarification are proposed.

One consists in first treating the vinegar with a casein solution (prepared by dissolving casein in ammonia and then removing the ammonia under vacuum) at concentrations of from 1 in 750 to 1 in 2,000, followed by 0·1 gm. tannin per 100 c.c.

New Methods

Another method, and one which appears to have better possibilities, consists in a treatment with casein and bentonite. An addition is first made of 1 part of casein per 2,000 to the vinegar heated for 10 minutes at 70° C. After standing for 16 hours it is filtered, heated again to 70° C. for 10 minutes, and 0·1 per cent. bentonite added. After coagulating and cooling, the liquid is again filtered. A vinegar treated in this way remained clear and bright for 32 months. Some vinegars may require more casein—*i.e.*, 1 part per 1,000.

The third method involves the use of potassium ferrocyanide. By itself complete clarification is not obtained, while there is also a residual ferrocyanide content in the vinegar. More satisfactory results are given by the combined use of potassium ferrocyanide and a protein such as albumin or gelatin, preferably the latter. The gelatin, when added in sufficient quantity, will remove the residual ferrocyanide from a vinegar which has been heated with up to 500 parts per million of this latter.

The optimum quantity appears to be in the region of 300 to 350 parts per million, but the amount necessary is best ascertained by trial, while the gelatin required is determined by adding increasing amounts to a definite volume of the treated vinegar until the addition of ferric chloride to the coagulated and filtered sample produces no Prussian blue colour. If carefully carried out under chemical control, the residual cyanide is not more than 2 parts per million.

Apple Juice Concentrate

In the preparation of a concentrated apple juice suitable for conversion into a carbonated beverage by carbonation, difficulty has been experienced due to the volatility of the natural flavour-imparting esters and aldehydes. To overcome this, a special concentrator has been designed in which the expelled esters, etc., are collected and returned to the concentrate. Experimental work with such a plant is described by Carpenter and Smith (*Ind. Eng. Chem.*, 1934, 26, 449).

Prior to evaporation, the juice should be freed

from colloidal matter, which is done by the flash-heating process. This consists in heating the juice rapidly to 180° F. by passing through a tubular heater, and then, without exposure to air, cooling and filtering. A second filtration is unnecessary at this stage, as the final concentrate has to be filtered to obtain the desired clarity.

The gelling point of the concentrated apple juice appears to vary somewhat with the variety of apple, and as a concentrate which remains perfectly fluid is required, the extent to which evaporation can be carried is determined experimentally. Thus the juice from Rome Beauty and Russet apples can be taken down to about 55 per cent. solids, while that from Northern Spy could be evaporated to 71 per cent. solids and still remain fluid. This may be accounted for by the higher sugar-pectin ratio or by the higher *p*H value of the juice.

The Ester Impregnator

The method of operating the plant is first to concentrate a batch of juice *in vacuo* (20 inches) to the desired point, and transfer the concentrate to an arrangement termed the "ester impregnator." A fresh charge of a similar volume is now concentrated and the evolved esters, etc., condensed and passed into the previous concentrate. A little water is carried over, but this only reduces the solids from about 55-56 per cent. to 49-50 per cent.

The final concentrate is next carefully filtered, and if not simultaneously sterilised, pasteurised for 15 minutes at 170° F. after bottling. Higher temperatures are to be avoided, as they induce the formation of a brownish deposit in the bottle.

The only loss during preparation is the volatile acid, which is not returned with the esters to the concentrate, but this does not affect the flavour of the product. The colour is darkened slightly, but such is considered of minor importance. From 2 to 3 oz. of the concentrated juice are required for an 8-oz. bottle of the carbonated beverage, assuming that it is desirable to restore in the latter the original total solids content of the orginal juice.

Colloidal Constituents of Honey

The colloidal constituents of honey which are known to influence turbidity, colour, and caramelising temperature have been further investigated by Paine, Gertler, and Lothrop. The colloid contents of numerous honeys (carefully selected floral types) were determined by ultra-filtration through a collodion membrane. The quantity varied from 0·8 per cent. in buckwheat honey, down to 0·07 to 0·09 per cent. in orange, sweet clover, and mangrove honeys. There appears to exist some *general* relation between colloid content and colour, the darker coloured products having the higher percentage of colloid matter. The colloid matter could be divided into approximately equal parts of reversible and irreversible colloid, but the distinction was not so marked as is the case with cane sugar colloids, and both fractions were rich in nitrogen and mineral matter.

The nitrogen content of the colloid matter varied from 6·63 to 11·64 per cent., the average for 23 samples being 8·64 per cent. Beeswax, pentosans, crude fibre, and mineral matter were present also, the latter varying from 2·67 to 9·9 per cent. (average 4·99 per cent.). The ash contains large quantities of iron and silica (28·44 per cent. Fe_2O_3 and 22·23 per cent. SiO_2 in the case of Manzanita honey).

Vitamins in Sausage

It is reported that an attempt to add sausages to the somewhat formidable list of food products dosed with "sunshine vitamin D" has recently been resisted by the State of California, mainly on the score of the strong opposition raised by Dr. A. G. Boyd, who is in charge of meat inspection for the State.

It is becoming increasingly clear that some control will have to be exercised over this vitamin dosage of foodstuffs. So long as it is under medical supervision or confined to responsible manufacturing firms having adequately staffed laboratories, one cannot, of course, raise any reasonable objection, but the danger lies in competition forcing others less favourably equipped into the vitaminised field, with the result that the public may run perilously near being over-dosed with vitamins, the effects of which may be scarcely less serious than those resulting from an under-dosage.

Crab in Mayonnaise

The Germans are fond of a crab-mayonnaise preparation. The shelled and washed crabs are immersed for fifteen minutes in a solution containing 2 per cent. vinegar and 3 per cent. salt. After draining on sieves, the meat is mixed with mayonnaise and packed in cans.

THE FREEZING, STORAGE AND THAWING OF MEAT

By T. MORAN, D.Sc., Ph.D.
(Low Temperature Research Station, Cambridge)

In this article Dr. Moran discusses the broad scientific principles underlying the successful practice of freezing, storing and thawing of meat. It gives an indication of the importance of one department of research work carried out at the Low Temperature Research Station, Cambridge, under the direction of the Food Investigation Board of the Department of Scientific and Industrial Research.

FREEZING IS the ideal method of preservation because a frozen product will keep in wholesome condition for months or years and, unlike non-frozen foodstuffs, is not unduly sensitive to slight changes in the storage conditions such as temperature and humidity.

The problems involved in the freezing of meat can no longer be regarded as the concern only of the overseas producer or of the shipping companies carrying the meat to this country; apart from the interest of the British consumer, it is now generally realised that our own home-killed meat trade would gain by copying many of the methods of the large meat works or frigorificos—*e.g.*, ante-mortem control and preparation, the reduction of infection during slaughter and dressing, rapid cooling after slaughter, refrigerated rail transport, etc. Proof of this is to be seen in the growing number of public abattoirs and, more recently, the suggested larger unit, the centralised slaughter-house, in which the killing would be carried out on a scale sufficiently large to justify the collection of many by-products which are now either thrown away or at least not collected with the maximum efficiency.

Again, on the purely scientific side, the analysis of the changes which take place during the cooling and freezing of the muscle and fat of meat has yielded results of direct interest and application to all other refrigerated foodstuffs.

The changes in meat or any tissue which are evident on thawing must be analysed in relation to the whole freezing-storage-thawing cycle. The form of this cycle in terms of time and temperature determine the extent of change in the meat: to understand these changes it is essential to have a picture of the constitution or structure of meat, particularly the muscle.

Structure of Muscle

The structure of muscle has engaged the attention of physiologists for more than half a century, but it is only recently, following the work of Muralt,[1] Edsall,[2] and Smith,[3] that a satisfactory structure could be put forward.

Lean meat is composed of bundles of fibres, each fibre (approximately 40μ to 50μ diameter) being a collection of fibrils, the fundamental unit of muscle. According to von Furth,[4] muscle consists of myosin (a globulin), myogen (a pseudo-globulin), and soluble myogen fibrin. Finn[5] suggests that myogen fibrin is simply a denaturation product of myogen and is not present in living muscle. Muralt visualises the fibril (2μ diameter) as a thread of "solid" myosin (1μ diameter) surrounded by a liquid medium containing myogen (the sarcoplasm). The evidence for this is based on the X-ray pattern of resting and contracted muscle and the physico-chemical properties of myosin itself. One of the most striking properties of the muscle fibre is the alternate dark and light bands when it is examined under polarised light. Myosin in solution is also doubly refractive, and this is almost conclusive proof that it occupies the light bands in the muscle structure. The conception of "solid" myosin must not be taken too literally, because Smith has shown that the properties of myosin in living muscle are rather those of a weak gel.

During rigor mortis, lactic acid is formed and alters the properties of this gel, synæresis taking place, and the net thickness of the threads becoming smaller. This fits in with the often reported observation that it is impossible to squeeze out juice from living muscle, but within a short time after death relatively large quantities of fluid can be expressed by moderate pressures. In

FIG. 1. (×40.)

full rigor myogen is practically the only protein in this juice. Living muscle has a *p*H of 7·3 to 7·4, muscle in rigor a *p*H of 5·6 to 5·8.

Freezing of Living Muscle

Frog's muscle may be taken as an example, since the changes which take place in this muscle during rigor and on freezing are similar to those which take place in muscle generally—*e.g.*, beef, mutton, and fish. This muscle freezes at −0·42° C., and survives freezing provided its temperature is not lowered below −2° C.[6]. Freezing of the muscle promotes those chemical changes which are characteristic of contraction and rigor—*e.g.*, the change of glycogen to lactic acid[7] and the breakdown of phosphagen to creatine and inorganic phosphate.[8] In both cases the extent of breakdown is determined precisely by the temperature, the rate of change being greatest at −2° to −3° C. A further point—one of general importance in the freezing of tissues—is that the effects of freezing to a particular temperature (corresponding to the removal of a definite amount of water as ice) are identical with the effects of ordinary drying to the same amount.[6, 9]

This work on the freezing of living muscle has had important practical results, because it has been amply demonstrated that the curve connecting temperature of freezing and storage with extent of chemical change applies equally to the changes which take place during the storage of ordinary meat, fish, and other tissues.[10, 11, 12]

Freezing of Meat

When meat or any tissue is frozen and thawed the structure is altered, and "drip" or free fluid rich in protein drains away on thawing. In the case of meat the composition of the drip is reasonably constant under all conditions of freezing,[13] including rate of freezing, and corresponds to:

Water	.. .. ..	86·00 to 87·00 per cent.
Total solids	.. ..	13·00 to 14·00 ,, ,,
N	.. .. ..	1·88 to 1·92 ,, ,,
Ash	.. .. ..	1·29 to 1·30 ,, ,,
Total P	.. ..	0·14 to 0·17 ,, ,,
Inorg. P	.. ..	0·08 to 0·13 ,, ,,
Refractive index	..	1·358
Relative viscosity	..	1·5

Lean meat freezes at −1° (30·2° F.) very approximately. As the temperature is lowered, more and more ice is formed until a temperature in the range −40° to −60° C. is reached, when all the free water is frozen. There still remains, however, a certain amount of bound water attached to the proteins (of the nature of water of hydration), roughly 0·3 to 0·4 gm. per gm. of protein, and by its very nature this will not be completely frozen until the temperature of −273° C. is reached. Heiss[14] has recently determined the amounts of water present as ice in frozen meat at different temperatures and obtained results which are in accord with measurements made in this laboratory.

Temperature.	*Percentage of Water Frozen.*
−2·5	63·5
−5	75·6
−7·5	80·5
−10	83·7
−20	89·4
−32·5	91·3

Ice Formation

The number and size of the ice crystals in a piece of frozen meat can be observed by fixing the tissue in the frozen state. A convenient method is to take the piece of frozen meat and mount it rigidly by embedding it in gum on the microtome (which with all the instruments and reagents employed is first cooled down to the actual freezing temperature). As each section is cut it is floated on the pre-cooled reagent (*e.g.*, strong formalin-alcohol

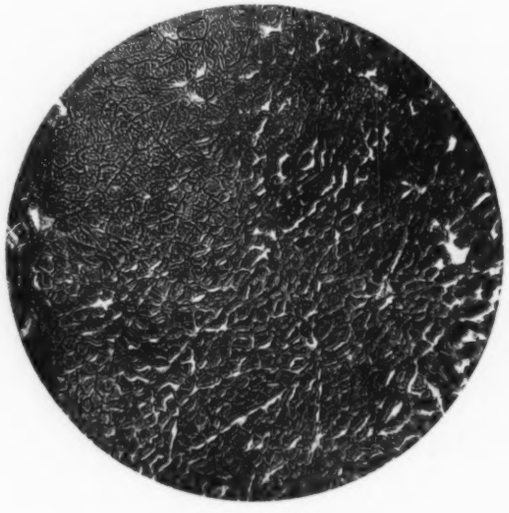

FIG. 2. (×40.)

mixture). The average thickness of the sections does not exceed 40μ, and therefore they are fixed in a very short time. They are next brought out to ordinary temperatures, transferred to water, stained in hæmatoxylin solution, followed by van Gieson's fluid, cleared, and mounted in Canada balsam for a permanent section.

Fig. 1 shows a section of beef frozen at $-20°$ C. The bulk of the ice is formed outside the individual fibres; this is due to the cohesive forces inside the fibre and is characteristic of colloidal systems in general, *cf.* gelatin gels.[15] The tendency for the ice to be formed *outside* the muscle fibre rather than inside has also been demonstrated by the ingenious experiments of Chambers and Hale,[16] who followed the freezing of individual muscle fibres under the microscope.

Rapid Freezing

It has been claimed that if meat or any tissue rich in water is frozen very rapidly there is little or no structural alteration in the tissue. The rapid freezing of foodstuffs is apparently well established in America, but while there has been considerable progress there on the technical side, comparatively little work has been carried out on the purely scientific problems involved, particularly with meat. Rapid freezing does appear to be effective for certain foodstuffs—*e.g.*, fish and milk—but for ordinary red meat it is not so satisfactory. The rapid freezing of meat and gels has been defined, a convenient measure being the time for the material to cool and freeze from 5° to $-5°$ C.[17] If this time does not exceed about 50 minutes the material can be regarded as rapidly frozen. In Fig. 1 this time was 236 minutes and, by contrast, in Fig. 2 the time was 4 minutes.

Experiments with beef, lamb, and offals such as sheep's liver, do not bear out the claim that rapid freezing gives a product much superior to that given by ordinary air freezing; there is practically no reduction in the amount of drip and no difference as regards palatability. In these experiments 90 samples of meat were frozen rapidly and stored at different temperatures for different times. Control samples from the same muscle, same animal, were frozen slowly and stored at the same temperature for the same time. All samples were numbered and examined for palatability by an expert panel drawn from the research staff of Messrs. J. Lyons and Co. The different qualities that go to make up the general term palatability—*e.g.*, tenderness, flavour, juiciness, etc.—were given marks based on ideal standards. The results when analysed were definite; no difference in palatability could be detected between the rapidly frozen and the slowly frozen samples. A full account of this investigation was published.[18]

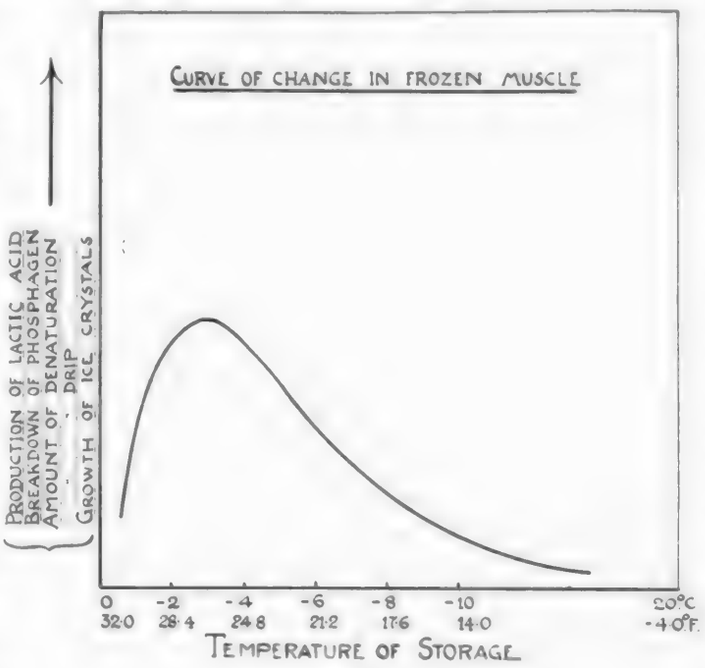
CURVE OF CHANGE IN FROZEN MUSCLE
PRODUCTION OF LACTIC ACID
BREAKDOWN OF PHOSPHAGEN
AMOUNT OF DENATURATION
DRIP
GROWTH OF ICE CRYSTALS
0 -2 -4 -6 -8 -10 -20°C
32·0 28·4 24·8 21·2 17·6 14·0 -4·0°F.
TEMPERATURE OF STORAGE

FIG. 3.

Storage of Meat

The moulds found on meat cease to grow at $-7°$ C. (Tomkins), while Haines (paper in the press) finds no growth of bacteria on frozen meat below $-3°$ C. Meat stored at $-8°$ C. or below is therefore safe from attack by micro-organisms, while at this temperature oxidation of the fat of beef or mutton is negligible over a period of 18 months.[19] Bacon, however, by contrast, oxidises rapidly even at temperatures as low as $-10°$ C.[20] A detailed discussion of the factors involved in the storage and transport of frozen meat is given in Special Report No. 41, "The Freezing, Storage, and Transport of New Zealand Lamb." Recent work has added to our knowledge of the changes which take place when meat is frozen and stored. Finn[5] has found that the protein myogen in muscle is gradually denatured during storage and the denaturation is maximal at a temperature in the region of $-2°$ to $-3°$ C. He explains this denaturation on the changes in salt concentration and *p*H of the frozen muscle. It has also been found that the small ice crystals present in rapidly frozen tissues decrease in number and increase in size at high temperatures, and only remain unchanged if the temperature of storage is $-20°$ C. ($-4°$ F.) or below.[10] This is an important point in the storage of rapidly frozen foodstuffs. Unless the temperature of storage is low these products will gradually revert to the condition characteristic of slowly frozen materials. With the change in ice formation there is also a change in the amount of drip on thawing from meat or fish. This depends upon the temperature of storage, and is again a maximum after storage at $-2°$ to $-3°$ C. The curve shown in Fig. 3 is therefore one representative of most of the changes so far observed in the freezing and storage of meat and fish and probably other tissues.

Explanation of Drip

When dry gelatin is immersed in water at ordinary temperature it will swell until its concentration is approximately 10 per cent., corresponding to an uptake of 9 gm. of water per gm. of dry gelatin. This is made up of bound water and water taken up, probably by the operation of the Donnan effect, by the gelatin aggregates or micelles. On the other hand, weaker gels can of course be prepared by dissolving the requisite amount of gelatin in hot water. A 2 per cent. gel, for example, is made up of micelles of swollen gelatin arranged in random fashion, enclosing pure water or a weak solution of gelatin in water. When such a gel is frozen and thawed the structure is disorganised and the interstitial fluid (practically pure water) drains away.

Consider the problem of drip from muscle. The following facts appear to be established:

1. The Muralt structure already described.
2. Drip only drains away from cut surfaces; it does not escape from an intact muscle (this is probably the reason why mutton is said to drip less than beef—the cut surfaces are less).
3. Juice can be pressed out of unfrozen meat in composition practically identical with that of drip.[13]
4. The conditions favouring denaturation increase drip.[10]

The facts fit in with the theory that drip is simply the escape of the myogen sol (sarcoplasm), possibly diluted with liquid from the breakdown of the weak myosin gel of the fibril threads. Denaturation (although only shown so far for myogen) of the myosin would tend to increase drip because of the lower water uptake after freezing and thawing of the denatured protein particles in the threads. This theory is, of course, different from that ascribing drip to the mechanical rupture of the fibres by ice crystals.

Thawing of Meat

There is some theoretical foundation for urging slow thawing to reduce drip, but it has probably been over emphasised. The theoretical basis is, of course, to allow time for the frozen dehydrated colloid particles to take up the maximum amount of water. Empey, in fact, could detect no effect of the rate of thawing on the amount of drip from beef. Frozen carcases of mutton and lamb and pork are sold frozen in the wholesale markets, and because of their size there is no suggestion that they should be sold otherwise. With frozen offals it is very desirable that they should be hard frozen when sold. On the other hand, with beef many attempts have been made to devise a satisfactory method of thawing with the idea of (1) reducing the time taken for a quarter to thaw—in ordinary air it takes 4 to 5 days, (2) reducing the drip on thawing, and (3) improving the external appearance of the thawed quarter. The first and third of these objectives have been reached, but no method has been proved to be effective with regard to (2). Stiles[21] has worked out in detail the factors which influence the rate of cooling and freezing of a body. They are:

1. The conductivity of the substance of which the body is composed. The rate of cooling will be more rapid the greater the conductivity of the body.
2. The specific heat and density of the substance. The greater the specific heat and density the slower

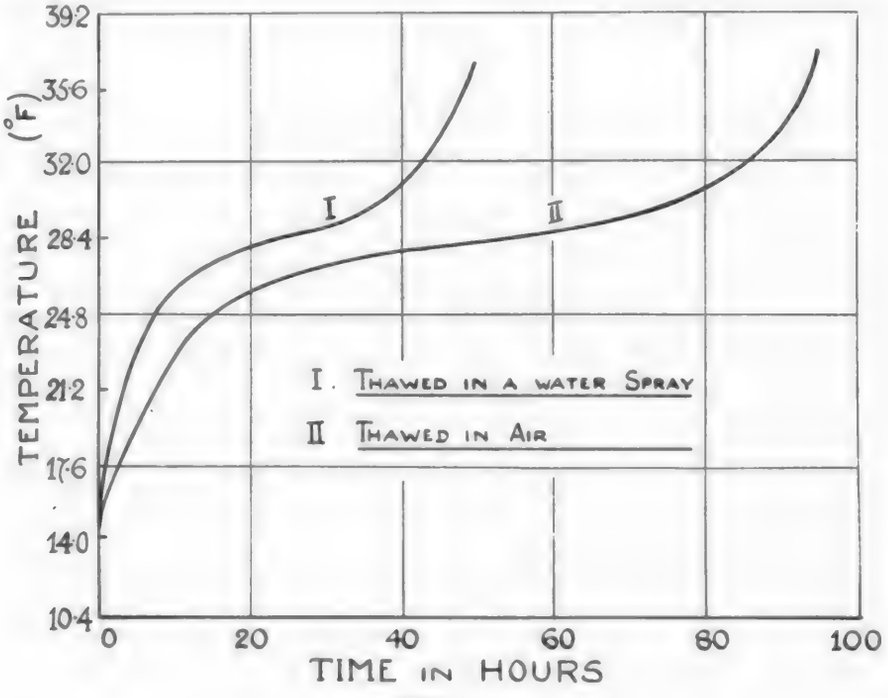

FIG. 4.

must be the rate of cooling.

3. The surface of the body. For the same mass of the body, the rate of cooling will also depend on the extent of the surface; the greater the surface exposed to the cooling medium the more rapid will be the rate of cooling.
4. The temperature of the external medium.
5. The conductivity of the external medium. The rate of cooling will be more rapid the greater the conductivity of the cooling medium.
6. The specific heat and density of the external medium. The rate of cooling will be more rapid the less the specific heat and density of the external medium.
7. The extent to which the external medium is agitated. The rate of cooling will be greater the more rapidly the medium is kept in motion.
8. The surface conditions of the cooled body, in so far as they influence radiation from the surface.

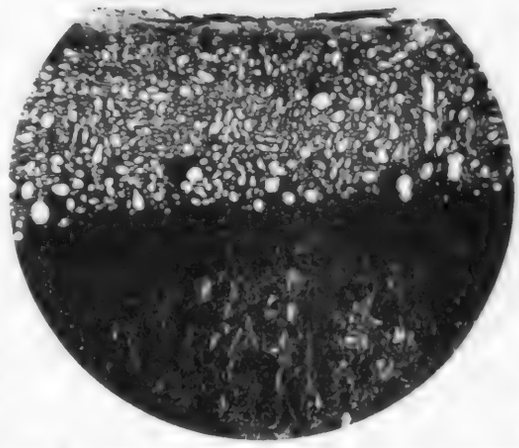

FIG. 5.—Showing "finger burn" in partially thawed lamb's kidney.

The factors influencing the rate of thawing are precisely the same as those influencing the rate of freezing, but it is clear that the conditions which can be most easily varied are the nature of the surrounding medium and its temperature. The most rapid thawing is achieved by using water because of its high thermal conductivity. Fig. 4 shows the thawing curves for the centre of a small hindquarter frozen to 14° F. and thawed (1) in air and (2) in a water spray bath at 48° F. The ratio of the times taken for the centre of the quarter to warm from 14° to 34° F. in air and water is 2·0. This ratio fits in with the theoretical equation developed by Plank and quoted by Stiles.

Several methods have been suggested for the rapid thawing of hindquarters of beef. One general method is to thaw with steam and hot air, followed by dry air of gradually diminishing temperature. This thaws the quarter rapidly and at the same time prevents the formation of slime on the surface, which frequently occurs if a hindquarter is thawed for 4 or 5 days at ordinary temperature. In addition, the surface of the meat being dryer, its colour is improved. If the surface of a carcase is moist it allows the collagen fibres in the surface connective tissue to swell, thereby giving the carcase a white, opaque appearance. Where speed of thawing is not so important the surface of the meat can be kept in good condition by thawing in air and controlling the temperature and humidity of the air circulating over the meat. Another method that has been suggested is to place electrodes at various points in the case and pass an alternating current between them.

Colour of Meat

The colour of meat is due to the presence of the red pigment hæmoglobin. This pigment can be oxidised to the brown darker pigment methæmoglobin. This change takes place more rapidly when the pressure of the oxygen is of the order of 4 mm.[22] For this reason, if a sample of stored beef is examined, it will frequently be found that there is a dark brown discoloured layer, not at the actual surface but at 1 or 2 mm. from the surface. Similarly, in high concentrations of carbon dioxide (the gas storage of meat) the partial pressure of the oxygen is reduced and therefore discoloration occurs nearer the surface and is therefore more noticeable.[23] Methæmoglobin is formed in the frozen state, being less the lower the temperature. Thus Brooks finds that whereas there is significant discoloration after 8 weeks at −5° C. there is none after 15 weeks at −20° C. In meat which has been frozen and thawed the rate of pigment oxidation is increased, and frozen meat therefore suffers from the handicap that its colour is not so bright as that of unfrozen meat.

The presence of sodium chloride greatly increases the rate of oxidation of hæmoglobin, due partly to the decrease in *p*H of the tissue. This is the reason why meat frozen rapidly by direct immersion in cold brine discolours very rapidly on thawing.[24]

Loss of Moisture

Linked up with the question of colour of meat is the effect of drying or loss of water during storage. Unfrozen muscle goes darker on drying, due to the increased concentration of pigment at the surface and to the increased transparency of this layer. With frozen meat, however, where the meat has a more "rigid" structure, drying merely results in the formation of a number of air pockets in the tissue, and as a result it is lighter in colour, or "corky," as it is sometimes described in the trade. This is largely an optical effect due to the scattering of light by the honeycomb structure of the meat, and if the spaces between the fibres are filled with a liquid whose refractive index is greater than air—*e.g.*, benzene—the red colour of the meat is immediately restored.[25] This type of drying is of considerable practical importance in the storage of such products as frozen kidneys, livers, hams, etc. The drying usually appears in patches and is referred to as "freezer burn" (Fig. 5). It can be obviated by suitable wraps which will prevent the passage out of water vapour.[26] The question of wraps is an important one. Much consideration has been given

(*Continued on page 208*)

Cleaning-up the Herds

By A. G. Norman, D.Sc., F.I.C.
Rothamsted Experimental Station

MY ATTENTION has been drawn to the April issue of your journal, in which certain rather pungent editorial comments on the Milk Marketing Scheme are suspended on the small hook provided by my article on milky wastes. It is clear that the Scheme is intended to do more than control the sale of milk, and hence your claim that there should be some direct provision for research on milk and milk products is justified. While I am entirely with you in this, I do not find myself in such complete agreement with two other points you raise. The "cleaning-up of the herds" is an easy and glib phrase, but few people realise exactly what it implies in initial cost and continual expense. That in the long run it would be worth while to the public is unquestionable, but it would never be financially worth while to the farmer. Few of them indeed are in a position to contemplate it. When we speak of "cleaning-up the herds" it is usually the stamping out of bovine tuberculosis that is in our minds. Certain states of America have undertaken this task, and one, at least, so successfully that it can say that all its herds are free. This has only been achieved by ruthless slaughtering of all animals reacting to the tuberculin test. The complete history of all herds is known, and every animal is periodically re-tested in case it has become infected. The cost was many million dollars. There is no doubt that the same could be done in this country, but it would be very expensive, far beyond the capability of the producers.

Inasmuch as it is in the interest of public health that milk should not contain pathogenic organisms, it is not unfair that the general public should foot the bill. No announcement has yet been made as to the extent of "cleaning-up" which is intended or contemplated. It is to be hoped that a really courageous effort will be made. It is not a thing that can be achieved in a twinkling of an eye, or by the passing of an Act in Parliament. Dairy cows are not produced like automobiles, and, as Sir John Russell has pointed out in his book, *The Farm and the Nation*, the farmers this year are determining the milk production two and three years ahead. Slaughtered animals could not be immediately replaced, and the process must be a gradual one. It is not the farmer's fault if his animals become infected—indeed, we do not know how cattle do become infected—and he should receive reasonable compensation for slaughtered animals. Strict veterinary and bacteriological control of herds will be essential, and the will of the public and the farmer must be behind the attempt. Many research problems will arise. There should, for example, be a thorough investigation of the tubercle organism in relation to infection and perhaps a refinement of the tuberculin test. It has been found that a certain small percentage of the animals reacting positively to the tuberculin test show no lesions on the lungs or elsewhere when slaughtered. These animals have become sensitised to certain acid-fast bacteria, common in soil and on pastures, which are harmless, but which are rather closely related to the tubercle organism, and consequently react with tuberculin. Apart from bovine tuberculosis there are certain other diseases, such as the contagious abortion produced by organisms of the Brucella group, and streptococcal infections of the udder which need stamping out.

Your second point, that a publicity campaign to increase the consumption of milk should be the concern of the vendors, is perhaps, in part, justified, though the vendors in a price-controlled industry of this sort are not exactly in the same position as those in a free-for-all market. The consumption of milk per head in this country is far lower than in the Scandinavian countries, Canada, and the United States. The return which the farmer receives depends on the amount of milk sold for liquid consumption relative to that used for milk products, inasmuch as the price received for the former is higher than that for the latter. It is reasonable to consider, therefore, that if consumption could be considerably increased by means of a vigorous publicity campaign, the return to the farmer would be increased also, as a higher percentage of the total output would fetch liquid milk rates. In the long run it is not improbable that the price to the public might be reduced, for it is higher now than in some countries. Entirely apart from these sordid financial aspects, it is generally conceded that it would be good for the health of the public that more milk should be consumed. The situation is not wholly Gilbertian.

The recent debate in the Commons emphasised the fact that this Scheme, along with the other Boards, was experimental, and not rigidly planned to operate along clearly defined lines. It may be that certain interests are overlooked. There is a strong case, as the *New Statesman and Nation* points out, for a Consumers' Council, active and fearless, to balance the producer influence which at present dominates the marketing machinery. The public must not baulk at paying a price that ensures an adequate return to the producer, provided that the product is the best that can be produced economically. Similarly the farmer must not baulk at the control inherent in a controlled industry if he seeks its shelter.

CHEMICAL PLANT EXHIBITION IN GERMANY

By The Editor

BACK IN London after a week in Cologne! We sit down to write some general impressions of the most amazing gathering of the chemical clans in which we have ever been privileged to participate. We refer to the seventh exhibition of German chemical plant and apparatus, otherwise known as "Die Achema VII.," held in the great exhibition building on the banks of the Rhine in Cologne from the 18th to the 27th of May.

The Achema was founded in 1920 by Dr. Max Buchner and his family, and the first exhibition was held in Hanover in that year. Then it occupied the modest space of 562 square metres. Its growth since those pioneering days has been extraordinarily rapid, as may be judged from the following figures:

	Square Metres.
Achema I., 1920, at Hanover ..	562
,, II., 1921, at Stuttgart ..	1,354
,, III., 1922, at Hamburg ..	1,407
,, IV., 1925, at Nuremberg ..	2,650
,, V., 1927, at Essen	5,300
,, VI., 1930, at Frankfort ..	9,000
,, VII., 1934, at Cologne ..	20,000

This is all the more remarkable in view of the fact that the Achema owes its birth and subsequent development to the genius of one man, Dr. Buchner, whose death only a few weeks ago came as a great blow to the chemical industry the world over. Now the responsibility for organising the exhibition has passed into the capable hands of Dr. Herbert Bretschneider, a man of unbounded energy, enthusiasm, and charming personality.

Friday, May 18, was devoted to opening functions which took the form of a Press gathering in the morning and an official ceremony in the afternoon. At 9.30 a.m. representatives of the Press met in a restaurant on the banks of the Rhine and near the exhibition building, where they received drink, literature (in bulk), speeches, and a hearty welcome. These were followed by food, more drink, and a short address by Dr. Bretschneider. It was all very convivial and informal. Then to the exhibition itself and a tour of the stands.

The second part of the proceedings was very interesting to the stranger—as will be gathered from the photograph at the head of this article. The band played, some resounding speeches were made, and finally, as the camera depicts, came a couple of rollicking songs which must have echoed to the farthest corners of the great building.

Truly it is a great building, for it embraces three spacious halls, one of which we show below, having a total floor space of 215,000 square feet. For five days we tramped up and down and among the stands and mingled with some of the 30,000 visitors who, like ourselves, had come to observe, ask questions, and add to their store of knowledge. We found this comparatively easy, because those in charge of the stands were mostly technical men, either chemists or practical engineers, and they were all able and willing to engage in discussion and argument on matters relating to their specialised interests.

It was also a relief to find that one could enter the precincts of the stands without being pounced down upon and pestered by those in charge of them. We have always found that is one of the chief discomforts of exhibitions; one is rarely left in peace to nose about among the exhibits; it would be a decided advantage, from the visitor's point of view, if the first advances were made by him and not by the exhibitor.

Another feature which we found worthy of the foot-

weary visitor's gratitude was the Foreign Visitor's Club, organised by Mr. H. R. Large, an English commercial consultant resident in Cologne. Here indeed was a peaceful refuge—and business discussions were "verboten"—which offered easy chairs and attendants ever ready to provide information in any language on all and sundry. There were, of course, other harbours into which one could drop one's anchor, so to speak, and in those it was possible to partake of cheap refreshments in the German style, without having to stand on one leg for half an hour in front of a bar.

To these arrangements for the comfort and general welfare of the visitor we might perhaps add the arrangement of the stands themselves, in the sense that they were all uniform in style and free from artistic embellishments. The ordinary business man and seeker after technical information is, in our view, greatly assisted in his task if his attention is not distracted and worried by these artistic efforts; he is—if we can judge him by our own reactions—primarily and principally concerned with the plant, machinery, and whatnot on and within the stands, and not in their architecture, however fine that may be. Thus we found that at the Achema the exhibits were definitely thrown into relief by the uniform, monotonous background of the stands themselves, thereby assisting concentration and lessening fatigue.

As for the exhibits, they ranged, as one might expect, over a wide field, from laboratory instruments and apparatus to heavy grinding, mixing, and drying machinery. Drying plant, in particular, was prominent, and we noticed several installations which had broken away from conventional design. The wrapping, filling, and labelling plant was rather disappointing and in our opinion did not come up to the standard of the British plant. Stoneware and rubber-lined equipment was strongly represented, as were also laboratory porcelain and glassware and instruments of precision. There were several very interesting stands showing high-pressure plant, and several made a special feature of welding appliances. Pumps were exceedingly numerous, as were also air exhausters.

Dr. Bretschneider Explains.

There is, however, unfortunately, no space here in which to discuss in any detail the astonishing array of equipment dear to the heart of every chemical engineer. Sufficient to say that "seeing is believing" and that anyone interested in this branch of industry who did not go to Cologne has indeed missed a real "treat."

We had almost forgotten to mention that the Achema provided a gathering ground for the various German chemical societies. Their members rallied at the exhibition in their thousands, and many interesting papers were read during the course of the week.

As for the social arrangements, although there was no definite programme such as we had at the Paris Congress, nevertheless the visitor had no reason to complain or feel that he was a mere foreigner who might be a possible purchaser; on the contrary, one was actually embarrassed by the warm welcome extended from all sides; one was literally overwhelmed with friendliness, frankness, and good fellowship.

Ice Cream Powders

by

T. I. Woods, B.Sc.

DURING THE last few years the popularity and, therefore, the manufacture of ice-cream has increased to an extent which once must have been thought impossible. With the increased popularity has grown up a greater measure of standardisation in the product, due to the efforts of the Ice-Cream Association and to the policy of the large firms engaged in this trade. Before the war ice-cream was largely of two distinct types—the very rich "French" type and the "Italian" or custard type, the latter often being nothing better than a hokey-pokey. In these days, however, what is known as "American" ice-cream holds the field, and it is to this type that this article in the main refers.

The "American" Mix

Very briefly, the chief difference between the "American" ice-cream and the other types lies in the "body." In American ice-cream the body is largely supplied by milk solids, stabilised by means of a simple colloid, such as gelatin; in Continental ice-cream the body is supplied to a considerable extent by a filler—eggs in the French type and cornflour or other farinaceous substances in the Italian type. American ice-cream in this country is, at its best, a thoroughly wholesome product, extremely palatable, a valuable and well-balanced food, and a sound commercial proposition from the point of view of price.

This article has been written in response to the requests which from time to time we have received for information on Ice Cream Powders.

A common type of ice-cream would analyse approximately as follows:

Butter fat	.. ..	8 to 10 per cent.
Milk solids not fat	..	10 to 12 ,,
Sugar	..	13 to 14 ,,

with the colloid and flavouring in addition. These constituents may be introduced in a great number of different ways—the butter fat from fresh cream, full cream dried milk powder, milk or fresh butter; the other milk solids from skim or full cream milk, milk powders, or condensed milks, etc. Whatever the materials used, always bearing in mind that they should be of the highest quality, as ice-cream very quickly shows any taint or "off-flavour" in its constituents, and assuming that they are properly used, a similar product will be obtained.

"Cold Mix" Powders

In dealing with ice-cream powders, it should be realised that it is not possible to get butter fat in a stable powdered form. True, it is present to the extent of 25 to 26 per cent. in full cream milk powder, but this product does not keep as well as the skim milk powder, and so is not often used for manufacturing ice-cream powders. A very modern form of these powders and one which is increasing in popu-

larity is known as the "cold mix" ice-cream powder, in that no heating is required in the preparation of ice-cream from it. These cold mix powders all contain as their base skim milk powder, sugar, and a colloid. The general directions for use are to take 1½ to 1¾ lb. to the gal. of milk, or mixture of milk and cream, beat together and freeze, but it is obvious that mixes made on these lines would be thin, lacking "body," so the manufacturers often add some filler and increase the colloid so that the viscosity may be raised. Owing to the fact that these mixes are not heated, ordinary cornflour or other starchy fillers cannot be used, nor can gelatin be used as the stabiliser as this is insoluble in the cold. Other colloids in common use are gum tragacanth, gum arabic, or mixtures of the two, and certain mosses, like Irish and Iceland moss, or preparations of these. For fillers may be used very finely powdered dried egg-yolk—an expensive ingredient—or else substances such as soya bean flour. This latter, when obtained very finely milled and unextracted, is finding increasing favour.

In order, therefore, to make a batch of 100 lb. of ice-cream powder, the following recipe might be used:

Sugar, finely milled	.. ..	70 lb.
Skim milk powder	.. ..	17·5 ,,
Filler, say soya bean flour	..	7·5 ,,
Colloid, say gum tragacanth	..	5 ,,

Care should be taken in choosing the brand of milk powder, as many are not completely soluble. It is usually found that a powder prepared by the spray process is to be preferred. These ingredients, with any colour desired, should be very well mixed together—an efficient mixer will be required here—and packaged as soon as possible. The colour may be incorporated in the powder form if the following precautions be taken. First sift the powder colour through a 100-mesh sieve and then grind the required quantity into a portion of the sugar and sieve this into the batch in the mixer. Unless this be done, and it is easily done by hand, it is almost impossible to secure an even distribution of the colour, owing to the extremely small amounts, often less than 1 gram, required.

Colloid

The colloid, as most ice-cream makers know, is added to prevent the formation of ice crystals in the finished product when being stored. In the case of cold mix powders, however, a further function is performed, in that it helps to add body to the mix. Many of the proprietary brands of cold mix powder now on the market differ because of the varying amounts and kinds of colloid used. It is well worth while for any potential manufacturer of these powders to carry out exhaustive preliminary trials in order to determine which colloid is best suited to his product and purpose. Gum tragacanth is one of the most efficient, but it is relatively expensive, being 5s. or 6s. per lb. for a suitable grade. Gum arabic is very much cheaper but less effective, and, when present in sufficient quantity, is apt to impart a gummy taste and texture to the finished product. A mixture of these two imparts greater viscosity to the mix than either gum does alone. There is on the market now a cold-water-soluble powdered gelatin, which might be eminently suitable, but the writer has no personal experience of this product. A less obvious, but nevertheless important, function of stabilisers is that they prevent the coagulation of milk casein in the stomach, thus rendering the ice-cream more easily digestible.

Flavour

The formula given above for a cold mix powder did not include any flavouring, yet an ice-cream without it would be unpalatable to the general public. It is extremely difficult to obtain true, natural flavours in a powdered form, and the best way, therefore, is to make the powder as an unflavoured base and add the usual flavourings when making the mix. Should it be desired, however, to make a flavoured powder, this may be done in certain cases. For a vanilla flavour, vanillin, ethyl vanillin or coumarin may be used. The quantities would be about 3 oz. of pure clove-oil vanillin or ¾ oz. ethyl vanillin per 100 lb. of powder. Coumarin is rarely used by itself, but in minute quantities in conjunction with vanillin—about 0·75 gm. per 100 lb. of powder is sufficient. Naturally such minute quantities require very careful mixing, and some such method as is used for the colour is essential. Quite a good chocolate colour and flavour may be obtained by substituting a suitable cocoa powder for the filler and using half the quantity of vanillin as is used for the vanilla flavour.

There is one very good powdered coffee extract on the market which is wholly soluble and imparts a good quality coffee flavour to the mix. It is, however, rather costly, and it is usually preferable to prepare one's own extract, and add it to the mix, or else to use a good essence. Other flavours, such as strawberry and raspberry, if obtained in very concentrated, non-aqueous form, may be sprayed into the powder in the mixer, but the results are not very lasting nor entirely satisfactory, and cannot compare with using the crushed fruit, either fresh or canned.

Method of Use

When making up small amounts of mix—say, up to 5 gal.—the required amount of powder should be put on top of half the milk and whisked until thoroughly incorporated. The remainder of the milk and the cream is then added and well mixed. The mix is then ready for freezing, and is, therefore, extremely convenient for the small trader who has no facilities for heating or who wishes to make up another batch in a hurry for rush trade. In common with ordinary mixes, however, these mixes improve with ageing—that is, leaving in a cool place for twelve hours or so after mixing but before freezing. This improves the body and smoothness.

From the hygienic standpoint it is preferable to use a pasteurised milk in sealed containers for these cold mixes, as there is no heating process which would limit the number of undesirable bacteria. For this reason also even more scrupulous attention must be paid to the cleanliness of all utensils and surroundings. If these precautions be observed a pure, hygienic product should be assured.

When larger quantities are being made, a power mixer would be used, when the maker's directions should be

(*Continued on page 220.*)

DOG BISCUITS

A DISCUSSION

Part I.—By T. G. Joyce, B.Sc., F.I.C.

OF ALL dog foods, the biscuit is probably the most universal. Whatever the scheme of feeding may be, the biscuit usually finds a place. Excellent samples are on the market, manufactured on scientific principles by firms of highest repute, and one hesitates to pen any criticism, for they have served and still do serve a very useful purpose. They provide a most convenient method of feeding dogs. There is one point, however, which might be mentioned. Are they sufficiently standardised and the standards known to dog owners? The feeding of domestic animals is constantly being investigated all over the world, and views are continually changing. There are so many breeds and sizes of dogs, also dogs in hard work and dogs at play, that the list of dog foods is necessarily a long one to suit all conditions. The question of amount is easily regulated by dog feeders, but that of concentration or food value is a more difficult problem. The opinions of dog owners, veterinarians and food manufacturers are so varied that a writer cannot be dogmatic on the subject: he can only express an opinion. It would, however, help, if biscuit manufacturers, with regard to their products, were to state their standards, such as percentage of meat or of meat protein, apart from that of gelatin or of cereal; percentages also of fat and of mineral matter would be useful. Any information as to vitamins, etc., is always an advantage.

Another point is price. It may be that the lady with one dog, and that possibly a little one, does not concern herself very much about the cost per pound, her purchases being relatively small. The man, however, with a larger number, perhaps six, eight, or more, thinks of every penny spent in this way, and does not always consider these proprietary lines cheap enough compared with the cost of raw materials he can and often does purchase. Consequently, the manufacturer has to consider both the correct quality and the possibility of maintaining a price sufficiently low to compete with other foods.

With regard to the kind of food suitable for dogs in domesticity, this vexed question is too long to discuss here, but unless the food manufacturer knows for himself the views of dog owners, he cannot produce the goods.

There is no cut and dried recipe for a universal dog biscuit, though there are plenty of ways of making the assortment required. In feeding dogs, the one outstanding fact on which all seem to be agreed is that the principal part of the diet should be meat. The dog is by nature a carnivorous animal; his digestive apparatus, as shown by his teeth and intestines, is that of the carnivora. Man has tamed him and has produced specialised breeds, but his fundamental canine characteristics remain unchanged. His food was raw meat and bone, and to-day he will always pick out the meat from a mixed diet when he has the chance, and he delights in a bone. If, from necessity, he must eat vegetables, he will do so; but he can digest most of these only with difficulty, if at all. If he should show a taste for any particular kind, it is an acquired rather than a natural one.

In considering the food of the wild dog, one must remember the privations and hardships he has to undergo in order to live. His energy requirements are great compared with those of the domesticated animal. He is lean and wiry, while our dogs are sleek and well cared for. Consequently, it is not surprising that a different food is satisfactory or even necessary for his well-being.

An all-meat diet for the domestic dog, while giving him courage, is not best fitted for his general condition. There is the danger of skin trouble, and the meat diet is best reduced and the bulk made up with vegetable substances.

As already mentioned, many vegetables are hard for dogs to digest or even not digested at all, but well prepared cereals have proved to be most satisfactory, thus providing the general idea for a dog biscuit. The biscuit should be hard baked. It is good for the dog to have to exercise his teeth and muscles, and for keeping purposes the moisture content must be as low as possible. All meat used must be dried. The best meat for the purpose is in the form of meat meal, the composition of which is known. Best flour, white or wholemeal, may be used, together with a little salt. Iodide, cod liver oil, and wheat germ may be added when desired. If equal parts by weight of meat meal and flour be taken as a basis, a product should result with a feeding value approximately equal to 100 per cent. fresh meat and 10 per cent. bone mineral matter. This may be diluted as required by further additions of flour.

In calculating food values for dogs, the basis should be the proportion of meat, and the cereal be considered as a diluent or filling.

Part II.—By J. Jessop

I am glad to have the opportunity of making a few remarks on the subject of Dog Biscuits. In the first place, it is my opinion that the canine population is very well provided for in respect of quality, variety, and prices, to suit all classes of feeders. There are about as many dog biscuit manufacturers as days in a year, many putting on the market an extensive variety, ranging from a plain dry, hard biscuit and plain wheatmeal biscuit to those containing specific amounts of meat and bone, fish and cod liver oil, also some containing milk, malt, and other specialised nourishing elements according to the dog's requirements. This does not cover a wide range of medicinal biscuits to assist the curing of those ailments to which the canine race is addicted. The pet of the house is not forgotten in a further range; he can now have his own specialised tit-bit, which contains fruit, including currants, figs, and dates, all impregnated during the manufacturing process.

Regarding concentrated foods, one is aware that a complete food in every biscuit is not the desire of the feeder, who knows full well that variety is the spice of life, and animals are no better than human beings in this respect, as they naturally like to ring the changes. The human being takes full advantage of all that the earth provides, including meats, fruits, fish, and vegetables, etc., yet no one would suggest that we should live entirely on one particular combination, in spite of the vegetarian's appeal to live without meat.

Dog fanciers now feed according to the breed and the purpose required. Greyhounds and sports dogs are given different food from the house dog and the slow moving dog of the bull-dog type. A catalogue of any reputable manufacturer gives feeders a wide choice in this respect. Concentrated feeding is not the sole aim of the majority of dog owners; they are aware that they must have bulk in order to satisfy the natural instincts of the animal, as they still eat by capacity for satisfaction.

The manufacture of a dog biscuit is now a specialised and scientific process, and to be a commercial proposition must have special plant, machinery, ovens, etc., costing anything from £2,000 upwards, according to the efficiency and production capacity aimed at, as the cost of hand labour would render the selling prices prohibitive if one is expected to make a reasonable amount of profit.

Competition keeps prices down, but so long as the public prefer to buy in small quantities and judge the value of the biscuit by the style of the container, which necessarily adds to the price, and nothing to the feeding value, then so long will fancy prices rule for that class of buyer. The feeder who knows what he wants in feeding value, from a plain meatless food to one containing 25 per cent. and upwards of meat and mineral value, has to-day no difficulty in getting all his requirements satisfied at a reasonable price, when one takes into account the cost of manufacture.

I disagree with the view that meat constitutes the only food of value for the animal world; even various classes of cereals add their quota of elements essential to a well-nourished animal.

Part III.—By J. Anderson

In my opinion one of the most useful of ingredients for dog biscuits is dextrose, with which is usually incorporated a certain amount of dextrin. Apart from the high food value of dextrose, which is common knowledge, my experience has been that this addition improves the texture and bloom of the biscuit, and confers better sealing qualities on the product, whereby the moisture content is conserved and drying out during storage is considerably delayed. At the same time this "skinning" or sealing greatly lessens the rate of absorption of atmospheric moisture on storage in damp surroundings. Two other points are worth mentioning. The presence of dextrose obviates the necessity for overbaking in an effort to obtain bloom, and it also renders the biscuit more attractive to the palate. Moreover, the factor responsible for bloom helps also in the production of that "crunchiness" which is so desirable a feature of dog biscuits.

Part IV.—By S. Madden

Although I agree with the main ideas in the article by Mr. Joyce regarding the feeding of dogs, I do think he has left out one of the mainstays in the feeding of our

dogs, which applies both to the domestic household and the, possibly more considered, kennel dog, for on his welfare and good condition generally depends his being, and sometimes the livelihood of his master. Personally I speak from the point of view of the owner of dogs that have a certain market value.

The feeding of these dogs is of vital importance, and I am always interested to hear the opinions and experiences of others on this subject, for therein, I am sure, lies the key-note that means success or failure.

I should like to say my experience is that, whilst meat in the correct proportion is absolutely necessary, I am a great believer in a certain amount of milk. The benefits to be derived from giving milk to a young puppy are known to everyone, but it does not occur to the majority what a lot of good can be done by giving it to the adult stock.

Stud dogs benefit enormously by it. Bitches who are in whelp should always have some. Young growing dogs to the age of twelve months should never be stinted. It is the only food for sick and convalescent dogs.

The Bakery Department of the Great Dane Kennels at Send, Surrey.

I have the opportunity of talking to some hundreds of breeders and owners throughout the year, and I am amazed by the large proportion who never even think of giving their dogs milk. They even go so far as to take the poor little puppies off it at the tender age of five weeks, and put them on an entire meat diet. I am convinced this is all wrong. The necessary fat that is to clothe the little puppy's bones is derived from his milk feed.

I do not by this, of course, advocate plain cows' milk; this is of no real value to the dog, as the milk from bitches is so different from that of cows.

Specially prepared milk is necessary, containing everything necessary for the building up of the body substances. A balanced milk—therein lies the secret of the bone formation in one's puppies—if given to the expectant mothers and continued after the weaning period, should obviate rickets and skin trouble in the growing stock.

I have known stud dogs, over-keen for the monopoly of all bitches about the kennel, go entirely off food; they may be kept fit and well, in a hard condition and able to do their work, on an entire milk diet. My own stud dogs never fail to get their daily ration of prepared milk.

I am afraid there is another point where I do not entirely agree with Mr. Joyce, and that is his non-advocation of vegetables.

I do not know whether a dog does, or does not, digest vegetables, but I think I am nearly correct in saying that ninety-nine out of a hundred dogs will eat raw carrot mixed with their food, and eat it with relish; some will even go so far as to eat up a raw carrot just thrown to them without other food, so that fact, combined with the ill-effects one gets if carrot is omitted from the diet sheet of any one dog, goes to prove that there is something absolutely vital to the well-being of the dog in this root vegetable.

I also have owned bitches who would go and sit in the middle of a cabbage patch and solemnly eat and eat away at a cabbage stump until the whole had disappeared—not the leaves or the heart of the cabbage, but just the stump. Some natural instinct must have made this palatable to them, and in consequence they would derive benefit from it.

I agree that cooked vegetables are worse than useless to the dog.

WOOD BEETLES

A READER informs us that a destructive wood beetle has entered most of his sitting-room furniture, and wants to know how to get rid of it.

One way is to burn the furniture. It has been suggested, as a preventative, to spray every six months with a mixture of 93 per cent. petrol, 4 per cent. linseed oil, and 3 per cent. citral. Claremont and Burnet, on the other hand, suggest painting on or injecting into the holes orthodichlorbenzene mixed with cedar wood oil and soap.

The best advice we can give is for application to be made to the Forest Products Research Laboratory, Princes Risborough, Bucks.

COW AND GATE FACTORY AT WINCANTON

By the courtesy of Messrs. Cow and Gate, Ltd., Guildford, we have been permitted to visit their factory at Somerton, near Wincanton, in Somerset, where milk is dried by the roller process. Mr. Folkes, the manager, first explained the system which he has developed for recording all relevant data appertaining to the supplies of raw milk, such as the location of the farms (which lie within a radius of five to six miles), the number of cows which they keep, and the amount and quality of the milk which they produce and deliver. This information is recorded on a large map and in a card-index file, which enable one to obtain in a moment all the necessary information about any particular supplier. One can also check the quality of deliveries in terms of the various tests to which they are subjected in the laboratories, and any faults in feeding, milking, or subsequent handling can be instantly traced and corrected. Furthermore, a bonus scheme is in operation whereby the farmer is induced to put his best efforts into improving the quality of his milk. It should be noted that each supplier is provided with a strainer for use at the farm.

On arriving at the factory, samples of milk are drawn from the churns for bacteriological and other laboratory tests. One such test, under the supervision of Mr. Folkes, is shown in operation in the first photograph on this page. The sample is forced through a filter disc, which retains any sediment, thus enabling an estimate

to be made in respect of its cleanliness. These discs are filed for reference.

The empty churns are immediately washed and sterilised in a rotary machine shown on the next page.

The milk which has passed the tests is then tipped into a tank (as shown in the second photograph) where it is weighed automatically and the weight credited to the supplier.

The milk is pumped up to the centrifugal cleaners to remove the natural slime content, consisting of micro-organisms, pus, hair, dust, blood, manure, etc.

After passing through the cleaning plant the milk is cooled to a temperature of about 10° C. It is then run into large tanks, where it is carefully examined and its composition finally standardised preparatory to drying. It is here that the fat content, which varies somewhat with the pasturage and the season of the year, is adjusted to a uniform value. This is an important point, particularly in connection with the preparation of infants' foods.

The milk is next piped to the drying department to be dried on a battery of roller machines of special design (see third photograph). The milk is directed on to the surface of the steam-heated revolving cylinders, from which it is removed by the "doctor knife" in the form of a thin fragile sheet (see photograph on next page). The temperature at the surface of the rollers is maintained below 98° C., and the time during which the milk is in contact with the rollers does not exceed three seconds, the thin film of steam preventing any oxidation. It is obvious that the rate of revolution of the cylinders and the rate of feed require very careful control.

After powdering, the milk is passed through sifting machines whereby it is brought to a uniform degree of fineness. Before packing is commenced the powder is subjected to further laboratory tests. Packing is carried out by means of automatic (electrically operated) weighing machines. Thus the powder is filled into parchment bags, which are placed in tins sealed by a vacuum process recently introduced. The milk is entirely untouched by hand throughout all these operations.

The addition of starch to milk preparations was formerly recommended on the ground that the assimilation of casein was thereby made easier. However, starch is never found in any type of milk in nature, and the digestive organs are not equipped to deal with it during the first seven months after birth. Consequently the addition of starch to the diet during the first seven months makes unnatural demands on the system, and by disturbing the ratio of proteins, fats, carbohydrates, etc., may lead to rickets and scurvy. Modern processes modify the casein and render it so digestible that the curd is fine and flocculent. Moreover, the method employed at one time, of adding starchy material to raw milk, is open to all the grave objections to the use of raw milk itself, with considerable likelihood of infection by tuberculosis or one of the many other diseases carried by it.

A food containing starch, suitable as an introduction to mixed feeding after seven months, has one quarter of its starch content predigested, and has, moreover, a normal fat content.

Sterilising the Churns.

A Dried Film of Milk being Removed from the Surface of a Roller Dryer.

THE FREEZING, STORAGE AND THAWING OF MEAT

(Continued from page 197.)

to the possibility of wrapping carcases of frozen mutton and lamb, but no suitable wrap has yet been found. Frozen lamb loses approximately 4 per cent. of its weight between slaughter and sale. If this loss of water could be reduced by 1 per cent. the gain to the New Zealand meat industry alone would be of the order of £100,000 annually. In addition, the colour or "bloom" of the meat would be improved so that it would command a higher price.

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Pressure in Cans

By
P. Chambellan
H. Cheftel
M. L. Thuillot
R. Boudeau

PART II.

INSTEAD OF developing this formula for the general case, which would have given us an unwieldy equation to handle, we preferred to prepare separate tables and diagrams, immediately giving us the values of various terms of the equation (3). In this way it becomes easier to introduce the corresponding values into this equation and then to calculate p_f, after the simplifications, offered by each particular case, have been effectuated.

TABLE I.

CAPACITY OF CANS AT TEMPERATURES FROM 0° TO 120° C.

	Can L3.	*Can L6.*	*Can L7.*
0°	$V_0 = 425$	$V_0 = 850$	$V_0 = 1700$
10	425·156	850·312	1700·624
20	425·312	850·625	1701·250
30	425·468	850·937	1701·874
40	425·624	851·249	1702·498
50	425·780	851·561	1703·122
60	425·937	851·874	1703·748
70	426·093	852·186	1704·372
80	426·249	852·498	1704·996
90	426·405	852·810	1705·620
100	426·561	853·123	1706·246
110	426·717	853·435	1706·870
120	426·873	853·747	1707·494

This table gives the capacity at $t°$ C, of cans whose capacity at 0° C is known. It enables us to calculate the term

$$V_f = V_i \frac{1 + \Delta t_f}{1 + \Delta t_i}.$$

The coefficient of cubic expansion equals three times the coefficient of linear expansion, which for iron is comprised between (116.10^{-7}) and (144.10^{-7}). Experimentally, we have ascertained that a sealed can whose length at 18° C. is 118.06 mm., measures 118.18 mm. at 100° C.

For us this experiment settles the coefficient of linear expansion of tinplate as being equal to 123.10^{-7}; consequently, the coefficient of cubic expansion will be 369.10^{-7}.

This last figure has been used in our calculations.

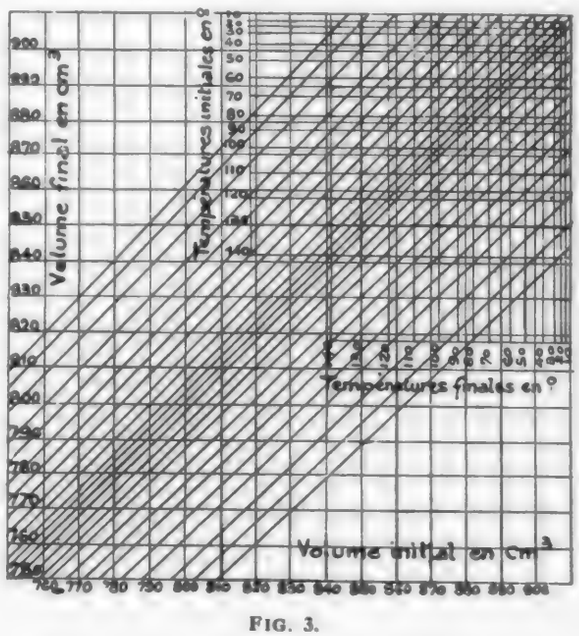

FIG. 3.

The "graph" (Fig. 3) gives the final volume of a mass of water, when we know its initial volume, its initial and final temperatures. It allows to calculate the term

$$v_f = v_i \frac{1+\beta t_f}{1+\beta t_i}.$$

TABLE II.

PRESSURE OF SATURATED WATER VAPOUR AT VARIOUS TEMPERATURES

t=temperature. F=steam pressure in kg.

t	F	t	F	t	F	t	F
0	0·0063	33	0·0509	66	0·2658	99	0·9969
1	0·0067	34	0·0538	67	0·2779	100	1·0334
2	0·0072	35	0·0569	68	0·2904	101	1·0709
3	0·0077	36	0·0601	69	0·3034	102	1·1096
4	0·0083	37	0·0635	70	0·3169	103	1·1494
5	0·0089	38	0·0670	71	0·3309	104	1·1903
6	0·0095	39	0·0708	72	0·3455	105	1·2325
7	0·0102	40	0·0747	73	0·3605	106	1·2759
8	0·0109	41	0·0787	74	0·3761	107	1·3205
9	0·0117	42	0·0830	75	0·3923	108	1·3664
10	0·0125	43	0·0875	76	0·4090	109	1·4136
11	0·0133	44	0·0922	77	0·4264	110	1·4623
12	0·0142	45	0·0971	78	0·4443	111	1·5121
13	0·0152	46	0·1022	79	0·4629	112	1·5635
14	0·0162	47	0·1075	80	0·4822	113	1·6162
15	0·0173	48	0·1131	81	0·5021	114	1·6704
16	0·0184	49	0·1190	82	0·5227	115	1·7261
17	0·0196	50	0·1251	83	0·5440	116	1·7823
18	0·0209	51	0·1314	84	0·5660	117	1·8420
19	0·0222	52	0·1381	85	0·5888	118	1·9023
20	0·0236	53	0·1450	86	0·6123	119	1·9642
21	0·0251	54	0·1522	87	0·6366	120	2·0278
22	0·0267	55	0·1597	88	0·6617	121	2·0930
23	0·0284	56	0·1676	89	0·6876	122	2·1599
24	0·0302	57	0·1757	90	0·7144	123	2·2286
25	0·0320	58	0·1842	91	0·7420	124	2·2990
26	0·0340	59	0·1931	92	0·7705	125	2·3712
27	0·0360	60	0·2023	93	0·8000	126	2·4453
28	0·0382	61	0·2119	94	0·8303	127	2·5212
29	0·0405	62	0·2219	95	0·8617	128	2·5991
30	0·0429	63	0·2322	96	0·8939	129	2·6789
31	0·0454	64	0·2430	97	0·9272	130	2·7607
32	0·0481	65	0·2542	98	0·9616		

This table gives the pressures of saturated water vapour as functions of the temperature and enables us to calculate the terms F_i and F_f.

Table IV gives the values of the binomial of air expansion for temperature between 0° and 130° C. It gives us the means to calculate the term

$$\frac{1+\alpha t_f}{1+\alpha t_i}.$$

By means of the equations (1) and (4) and of the tables given above, we are in a position to calculate the inner pressure to which the can is subjected in the various cases.

We insist on the fact that this general equation has been established for a 100 mm. end; for ends of other dimensions, it is, of course, necessary to determine the corresponding value of the term A_c, starting from the

TABLE III.

SOLUBILITY OF AIR IN WATER (ONE VOLUME OF WATER DISSOLVES α VOLUMES OF AIR.)

Temperature t.	Coefficient α.
0°	0·0288
10	0·0226
15	0·0205
20	0·0193
50	0·0128
60	0·0120
70	0·0115
80	0·0111
90	0·0109
100	0·0107
110	0·0105

The above table give the coefficients of solubility of air in water at the various temperatures indicated and permits to calculate the terms s_i and s_f.

TABLE IV.

TABLE GIVING THE VALUE OF THE BINOMIAL OF AIR EXPANSION ($1+\alpha t$) AT CONSTANT VOLUME, FOR TEMPERATURES BETWEEN 0° and 130° C.

t	$1+\alpha t$	t	$1+\alpha t$	t	$1+\alpha t$	t	$1+\alpha t$
0	1·000,000	33	1·120,945	66	1·241,890	99	1·362,835
1	1·003,665	34	1·124,610	67	1·245,555	100	1·366,500
2	1·007,330	35	1·128,275	68	1·249,220	101	1·370,165
3	1·010,995	36	1·131,940	69	1·252,885	102	1·373,830
4	1·014,660	37	1·135,605	70	1·256,550	103	1·377,495
5	1·018,325	38	1·139,270	71	1·260,215	104	1·381,160
6	1·021,990	39	1·142,935	72	1·263,880	105	1·384,825
7	1·025,655	40	1·146,600	73	1·267,545	106	1·388,490
8	1·029,320	41	1·150,265	74	1·271,210	107	1·392,155
9	1·032,985	42	1·153,930	75	1·274,875	108	1·395,820
10	1·036,650	43	1·157,595	76	1·278,540	109	1·399,485
11	1·040,315	44	1·161,260	77	1·282,205	110	1·403,150
12	1·043,980	45	1·164,925	78	1·285,870	111	1·406,815
13	1·047,645	46	1·168,590	79	1·289,535	112	1·410,480
14	1·051,310	47	1·172,255	80	1·293,200	113	1·414,145
15	1·054,975	48	1·175,920	81	1·296,865	114	1·417,810
16	1·058,640	49	1·179,585	82	1·300,530	115	1·421,475
17	1·062,305	50	1·183,250	83	1·304,195	116	1·425,140
18	1·065,970	51	1·186,915	84	1·307,860	117	1·428,805
19	1·069,635	52	1·190,580	85	1·311,525	118	1·432,470
20	1·073,300	53	1·194,245	86	1·315,190	119	1·436,135
21	1·076,965	54	1·197,910	87	1·318,855	120	1·439,800
22	1·080,630	55	1·201,575	88	1·322,520	121	1·443,465
23	1·084,295	56	1·205,240	89	1·326,185	122	1·447,130
24	1·087,960	57	1·208,905	90	1·329,850	123	1·450,795
25	1·091,625	58	1·212,570	91	1·333,515	124	1·454,460
26	1·095,290	59	1·216,235	92	1·337,180	125	1·458,125
27	1·098,955	60	1·219,900	93	1·340,845	126	1·461,790
28	1·102,620	61	1·223,565	94	1·344,510	127	1·465,455
29	1·106,285	62	1·227,230	95	1·348,175	128	1,469,120
30	1·109,950	63	1·230,895	96	1·351,840	129	1·472,785
31	1·113,615	64	1·234,560	97	1·355,505	130	1·476,450
32	1·117,280	65	1·238,225	98	1·359,170		

experimentally plotted curves of deformation. The following table gives the constants of the equation $y=px+q$ for the standard sizes of cans used for preserved vegetables.

Cans.	*Diameters.*	*p.*	*q.*
L1, L2	55·0	3·5	0·5
L3	71·5	7·0	6·0
L4	86·0	12·0	16·0
L5, L6, L7	100·0	20·0	21·0
L8	153·0	128·0	92·0

Later on, we shall consider some practical applications. It is, however, interesting meanwhile to examine the influence of the free space on the final pressure, on account of the theoretical deductions, which follow from it.

Let us again consider the equation (4):

$$20p^2 + \left[V_i \frac{1+\Delta t_f}{1+\Delta t_i} + 20\,(F_f - P_a) + 21 - v_i\,(1 - s_f) \frac{1+\beta t_f}{1-\beta t_i} \right] p - (w_i - v_i s_i)\,(P_a - EF_i) \frac{1+\alpha t_f}{1+\alpha t_i} = 0.$$

We want to examine how p_f varies with the variations of the initial free space w_i, this latter being equal to the difference between the initial volume of the can and the initial volume of the water; we may write:

$$w_i = V_i - v_i.$$

By introducing this value of w_i into the equation (4), we get:

$$20p^2_f + \left[V_i \frac{1+\Delta t_f}{1+\Delta t_i} + 20\,(F_f - P_a) + 21 - v_i\,(1 - s_f) \frac{1+\beta t_f}{1+\beta t_i} \right] p - (V_i - v_i + v_i s_i)\,(P_a - EF_i) \frac{1+\alpha t_f}{1+\alpha t_i} = 0.$$

In this equation, we shall keep constant all the factors except v_i, of which we want to investigate the influence. For this purpose we may write:

$$V_i \frac{1+\Delta t_f}{1+\Delta t_i} + 20\,(F - P_a) + 21 = k,$$

$$(1 - s_f) \frac{1+\beta t_f}{1+\beta t_i} = l,$$

$$(P_a - EF_i) \frac{1+\alpha t_f}{1+\alpha t_i} = m,$$

and substitute x for p_f and y for v_i. This is equivalent to fixing all the conditions, the height of the can (for a 100 mm. end) included, and to varying the volume of water only, and, consequently, the free space.

Our equation becomes

$$20x^2 + (k - ly)x - m\,(V_i - y + y s_i) = 0,$$

and the value of x, in which we are interested, will be

$$x = \frac{ly - k + \sqrt{k^2 + l^2y^2 - 2kly + 80m\,(V_i - y + y s_i)}}{40}.$$

The quantity under the root sign is always positive, because

$$V_i \geq y;$$

consequently x will always be real, and to each value of y will correspond a value of x.

If we differentiate x with respect to y, we shall have

$$x' = \frac{l\sqrt{k^2 + l^2y^2 - 2kly + 80m(V_i - y + y s_i)} + l^2y - kl - 40m + 40m s_i}{40\sqrt{k^2 + l^2y^2 - 2kly + 80m\,(V_i - y + y s_i)}}.$$

This function is real for any value of y comprised between 0 and V_i. The denominator being always greater than zero, x' will have the same sign as the numerator.

In order to ascertain whether this expression has maxima or minima or points of inflection, we put $x'=0$, which means that

$$l\sqrt{k^2 + l^2y^2 - 2kly + 80m\,(V_i - y + y s_i)} = kl + 40m - l^2y - 40m s_i.$$

This gives us:

$$l^2 V_i = (1 - s_i)\,(kl + 20m - 20m s_i). \qquad (5)$$

This equality, independent of y, is usually not fulfilled. Consequently the derivative never gets annulled and never becomes infinite; consequently the function increases or decreases according as the derived function is negative or positive. It is easy to determine its sign in each particular case.

So we see that, all the other conditions remaining the same, if the free space increases, the final pressure increases in the L6 can (4/4) and decreases in the L7 can (2/1).

The curves which follow, plotted with the help of the general equation, show the character of this phenomenon (Fig. 4). Both the mathematical calculations on the one hand, and the slope of the curves on the other, clearly show that among all the cans having 100 mm. ends, there must be one of which the final pressure is a constant for any given initial and final conditions, irrespective of the volume of the free space. This occurs when the equality (5) is fulfilled: in that case the derived function is annulled at every point, and the graph representing the pressure is a straight line parallel to the axis of the abscissae.

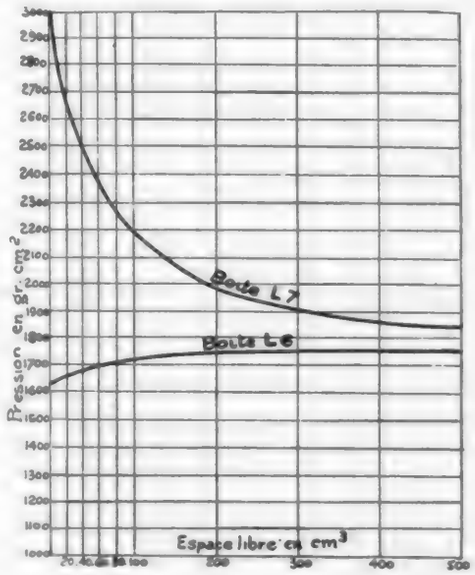

FIG. 4.—Cans L6 and L7 with Dissolved Gases.
$t_i = 10°$. $t = 110°$. $P_p = \varphi\,(\omega_i)$.

As it is easy to see, the equality (5) depends only on the volume V_i of the can—*i.e.*, on its height, since the ends are always the same. But we must insist on the fact that the initial and the final conditions must be given. For instance, with an initial temperature of 10° C., a final temperature of 110° C., an initial and a final pressure both equal to the atmospheric pressure, the factors l, m and k by their values given on page 209 and to introduce the conditions given. In our case, we shall have

$$E=0,\ s=0{\cdot}0226,\ s=0{\cdot}0105,\ t=10°,\ t=100°$$
$$P_a=P_e=1{\cdot}0334 \text{ kg.}$$

The other factors are calculated as functions of the

At Work in the Research Laboratories of Établissements J. J. Carnaud, Paris, where the experiments described in this series of articles were carried out.

and neglecting the hygrometric state of the air (which, at 10° C., need not be taken into account), the calculation shows that the volume of such hypothetical can is

$$V_i=942 \text{ c.c.}$$

To get this result it is sufficient to substitute in the equation

$$l^2V_i=(1-s_i)\,(kl+20m-20m\,s_i),$$

preceding ones with the help of the tables and of the diagrams. The particular case mentioned has been verified by us experimentally, by making a can of the capacity of 942 c.c. and having 100 mm. ends. This can when filled either with 250 c.c. or 900 c.c. of water (boiled and saturated with air free from carbon dioxide), shows the same final pressure P_{f_2} of 1·725 kg.; this figure agrees sufficiently closely with the theoretical figure of 1·740 kg.

(To be continued.)

CHOCOLATE ICING (Continued from next page.)

Recipe for Stock Syrup

Lump sugar	3 lb.
Water	1 qt.

2 drops of acetic acid on lump of sugar.

Boil to 220° F.

Place sugar and water in a pan and bring to the boil; keep sides of the pan clean, and take care that all sugar is dissolved before boiling point is reached. Add acetic acid, remove scum, allow to cool, and store in well-corked bottles.

This syrup is used for thinning down fondant when required, and also helps to give a glossy appearance. It must be used sparingly, otherwise the fondant will become sticky on cooling.

Recipe for Apricot Purée from Apricot Jam

I.		II.	
Apricot jam	8 lb.	Apricot pulp	10 lb.
Sugar	2 lb.	Lump sugar	10 lb.
Water	3 gills	Heat to 225° F. and sieve.	

Boil for 15 minutes.

CHOCOLATE ICING

By John T. Parker

National Bakery School
London

This article has been prepared in answer to the following enquiry :

"I am working on the preparation of an iced chocolate cake in powder form. The cake portion is quite satisfactory. For the icing I am using a mixture of cocoa, icing sugar, and vanilla essence. This gives an icing with a good flavour, and a nice gloss the first day. The trouble is that after the first day it loses the gloss, and occasionally small sugar crystals form after the icing has dried out. I want the preparation to be as simple as possible from the consumer's point of view.

"I have tried mixing the icing powder to a paste with hot water, cold water, hot milk, cold milk, melted butter, and also heating the icing in a pan, none of which has proved satisfactory.

"Can you recommend anything that will cause the icing to retain a smooth gloss?"

WATER ICING is not intended to be used as a finished coating or covering for large cakes. Owing to the nature of its ingredients and the method of making, it is only suitable for "quick sale goods." It is chiefly used on fermented articles, such as Swiss buns, college buns, coffee buns, etc., and on small cakes which are classed as "morning goods" to be sold the same day. It is usually made with boiling water to give a glossy appearance and to prevent any running, causing an untidy finish. If water icing is used on cakes which have to stand for more than a day the moisture is absorbed by the cake and the icing becomes dry and flaky. Where colours have been added a mottled and bleached appearance will result. The atmosphere will also cause this trouble. It is better to use fondant as a coating for larger cakes, because, when correctly made and used, fondant will retain its gloss for several days.

The following procedure should be adopted:

The cake must be prepared by masking the top and sides with highly boiled apricot purée, which must be brushed on while *hot*, care being taken to avoid too thick a coating. When this is cool enough to be touched without sticking to the finger the fondant can be applied. Sufficient fondant should be placed in a clean saucepan in a bain-marie or a double cooker and heated slowly until it attains a thick creamy consistency and is not more than 98° to 100° F. It can then be poured over the cake and will set in a few minutes. If the fondant is too hot it will lose its gloss. Fondant can be bought at a reasonable price or made as required.

Equipment

The equipment required consists of the following:

A sugar boiling thermometer; four 1-inch-square steel bars (two 3 ft. long and two 2 ft. long); two large spatulas; a marble slab.

Recipes

White Fondant.		*Chocolate Fondant.*	
Lump sugar ...	12 lb.	Lump sugar	8 lb.
Water	3 pt.	Water	1 qt.
Glucose	2 lb.	Glucose	1 lb.
or		Pure unsweetened	
Cream of tartar ...	½ oz.	block cocoa	2 lb.
Heat to 240° F.		Heat to 238°–242° F.	

Method of Making

Place sugar and water in a clean boiling pan; stir occasionally and bring to the boil, taking care that all sugar is dissolved before boiling point is reached. Keep the sides of the pan clean, to prevent crystals of sugar forming, by using a clean brush dipped in water. Remove the scum, add the glucose, and boil up quickly to 240° F. Place the steel bars to form a rectangle on the marble slab; sprinkle the enclosure with water, and pour in the "boil" as soon as it reaches 240° F. Allow to become almost cold; remove the bars, and begin to cream up with spatula, turning the sides to the middle and *vice versa*. Continue turning until it becomes creamy and begins to set, then rub down with the hands and place in earthenware jars and cover with damp cloths. Store in a cool place.

The same method is used when making the chocolate fondant, as far as the point at which the boil is poured on to the slab, then, while still hot, the block chocolate is finely shredded on to the surface and allowed to stand until the "creaming up" stage. It is then "creamed up" as for the white fondant, rubbed down and stored in earthenware jars.

(*Continued on previous page.*)

CREAM CHEESE

By Thomas McLachlan, A.C.G.F.C., F.I.C.

IN THE May issue of FOOD MANUFACTURE a correspondent asked how it was possible to prepare cream cheese from perfectly fresh cream in such a manner that it would keep fresh for three weeks. The casual chemist looking at the subject will remember the article published by the late Dr. Paul Vieth in the *Analyst* in 1886 on "The Composition of Cream Cheese." Dr. Vieth examined the fat of his cheeses after keeping them for one, two, three, and four months, and found little differences in composition on keeping. Although Dr. Vieth does not mention it, there can be little doubt that he preserved his cheeses fairly effectively with boric acid, and anyone acquainted with the subject might be tempted to question the possibility of obtaining a cheese which will keep fresh unless a preservative be added.

In this connection it may be well to describe the French method of preparing cream cheese, since this is the method adopted in most other countries also. If one is to accept the definition that cream cheese is the unripened cheese made by the Neufchâtel process from whole milk enriched with cream, I think that it will be conceded that one is entitled to use the French process as a basis for discussion. In this process five volumes of cream are mixed with thirty-two of fresh milk and brought to a temperature of 59° to 64° F.; sometimes a lower temperature is employed, but never a higher one, as the curd would tend to become too hard. The necessary quantity of rennet is added to allow of such a rate of coagulation that an unctuous curd is formed in about twenty hours. This curd is then fed slowly on to a cloth filter, folded over in the typical mattress style and placed in a lattice wood frame, with a light weight on the top. Drainage is completed in about fifteen to eighteen hours and the paste is stirred up with a further quantity of fresh cream and allowed to dry on a table for another hour, before being shaped by hand or by machine. Cheese prepared in this manner rapidly acquires a sour taste and a rancid odour; it is preserved by mixing with 2 per cent. of its weight of very dry, finely powdered salt, and will then keep for eight to ten days.

If this process is examined from the bacteriological point of view, all kinds of reasons become apparent why the cheese will not keep for very long. In the first place the milk is used fresh, containing all the bacteria picked up in the process of milking and carrying.

Next it must be remembered that although rennet will keep for a few months without much deterioration, as usually obtained it is not a sterile fluid, but contains trypsin-hydrolysing bacteria capable of attacking the curd of the cheese and upsetting its structure. This is in spite of the fact that rennet usually contains a small quantity of thymol as a preservative.

If we examine the process submitted for criticism by our enquirer, we see that he employs fresh cream—"perfectly fresh"—but why not pasteurised? There is a common belief that one cannot make even the homely junket with pasteurised milk, and bottles of rennet frequently have on their labels a statement to this effect. The greater the heat to which milk has been subjected the more difficult it is to curdle by rennet, owing to the action of heat on the calcium of the casein, but milk or cream treated by the holding process will curdle quite naturally with rennet. Secondly, it is possible to produce a sterile rennet, the chief necessity in its preparation being to take care to keep everything sterile. A sterile rennet is, of course, more easily obtained from powdered rennet than by the ordinary wet extraction; the powder keeps its activity over considerably longer periods than the solution. Finally there is the question of thorough sterilisation of utensils, the avoidance of handling the cheese more than necessary, keeping things covered to prevent the access of air-borne bacteria, and so on. Preferably the process should not be carried out in a factory where other cheese is made; the moulding machinery which is employed for other cheese should certainly not be used. Metal should be employed for the construction of frames as far as possible, as this is easily cleaned and sterilised. With these precautions it should be possible to obtain a cheese which is almost free from bacteria. The concentration of salt in the water phase, while it is only 2 per cent. on the cheese, will depend largely on the fat content, and the greater the fat content the greater will be the preservative action.

A cheese prepared from pasteurised cream or milk and cream by the action of acid, preferably lactic acid, would have to be passed as a "Cream Cheese" according to the Foods and Drugs Acts, so that there is no reason why, with proper packing conditions, cream cheese should not keep for three weeks; however, it will not keep once it has been exposed to the air.

For packing purposes, either tinfoil or the best quality parchment paper, thoroughly brined, should be employed.

HONEY SPOILAGE

By Professor H. F. WILSON of Wisconsin Agricultural Experimental Station.

PART II.

DISCUSSING CRYSTALLISATION, Lochhead and Heron[5] indicated that "the increase in moisture content, due to crystallisation, helps to explain why fermentation, often considered a fault of unripe honey, may occur in honeys which have been well ripened." In discussing "degree of inversion sugars," they called attention to the fact that "in otherwise similar honeys, then, those showing greater proportion of invert sugar to saccharose will have a greater osmotic pressure, and will consequently offer greater resistance to the action of yeasts." It was their opinion that "in cases where the moisture content was very close to the critical point the sugar ratio may well be a factor in helping to aid or prevent fermentation." Under the content of soluble nitrogen they believed that, "apart from the question of fermentable sugars, the readiness with which yeast will ferment will be affected by the presence of nitrogen compounds in the honey." This was demonstrated by a series of tests in which 60 per cent. solutions of honey containing added nitrogen in different forms were prepared and inoculated with yeasts.

The addition of nitrogen compounds as prepared by them showed an increased rapidity in the beginning of the fermentation process, and may offer an explanation as to why honey containing honeydew may be responsible for fermentation, which might not otherwise occur.

During our investigations at Wisconsin we have made similar investigations, except that the relation of both moisture and temperature as factors in honey spoilage have been studied concurrently.

Yeasts are, of course, necessary as the active agent in fermentation. The moisture content is also an important factor, as shown by almost immediate fermentation in honey containing 17 or more per cent. moisture and slow fermentation in honey containing a less percentage. However, the control factor has been definitely determined to be temperature. For honey containing a very high percentage of moisture does not ferment below 50° F., nor at a temperature somewhat over 80° F., while honey of relatively low moisture content will ferment at a temperature of 60° F.

The temperature factor is also the most important to the practical beekeeper, for by heating honey and immediately putting in sealed containers to prevent additional contamination by yeasts the fermentation problem is solved for him.

Relation of Hydrogen-Ion Concentration to Fermentation

As yet no evidence has been offered to show that the *p*H relation of honey has any bearing on fermentation in honey. Of Canadian honeys reported by Lochhead,[6] forty-seven have a *p*H of 3·6 to 3·9 for unfermented honey. Unreported *p*H determinations made upon honeys used in our investigations show a *p*H of 3·2 to 4·2 for samples in storage for a period of several years.

Titratable Acidity

Titratable acidity reported by Lochhead[6] for Canadian honeys ranges from 14·7 to 19·8 per cent. Titratable

acidity for Wisconsin honeys shows a range of 45·3 to 65·9 per 100 gm. of mgms. of NaOH.

No definite evidence has yet been published to show that the acidity has any relation to the problem of fermentation.

Relation of Temperature to Spoilage

Temperature appears to be the most important factor of honey spoilage, not only because of the part it plays as a contributing and control factor in honey fermentation, but also because high temperatures cause a loss of flavour and colour in unfermented honeys.

It has been conclusively shown at the Wisconsin Agricultural Experiment Station that the known yeasts in honey do not develop at temperatures below 52° F.[11] and only very slowly at 80° F. Growth is further inhibited at a higher temperature and completely stopped at a yet undetermined temperature somewhere between 80° and 100° F. It has also been shown that at 60° F. both so-called ripe and unripe honey will ferment, regardless of whether or not it came from completely sealed combs.[19, 20] These data are based on a large series of samples taken in 1929 and still under observation, except those which have been discarded because they could no longer be used or had spoiled.

Four complete sets of samples extracted at weekly intervals during the honey flow and stored in constant temperature chambers of 40°, 60°, 80°, and 100° F. have served as a basis for comparison. A sufficient number of samples were placed in storage so that one of each could be removed from each chamber at yearly intervals for seven years to determine what changes may occur in honey when it has been held in storage for a long period of time. However, at the end of the first year the samples in the 100° F. chamber had so badly deteriorated in colour and flavour as to be unfit for table use, and observations at this temperature were discontinued. At the end of one year the samples in the 80° F. chamber had deteriorated slightly in colour and flavour, but not sufficiently to damage their market value. At the end of the second year the colour had become slightly darker and the flavour was slightly flat. In the 60° F. chamber all but three of the series of samples had fermented after a year in storage.

One of three samples was extracted on July 24 from a set of combs about three-fourths sealed, and should have fermented, as honey from fully sealed combs extracted at later dates fermented within a few months after being placed in the storage chamber.[19] We are not able to decide upon the reason for lack of fermentation in these three samples, but certainly it could not have been the moisture content, for samples with even less moisture than two of the three samples fermented in a short time. It is possible that the yeasts were not sufficiently abundant in these samples to cause fermentation, for the yeast counts were extremely low.

In the 40° F. chamber the samples have remained in perfect condition for a period of three years, and still show no signs of fermentation or changes in colour or flavour. With this information available it may be readily seen that in the warehousing of unheated honey care must be taken in providing temperatures that are not favourable to the growth of yeasts in honey, nor so high that they cause chemical changes which affect the colour and flavour.

Honey stored in one of the dairy refrigerating rooms at 8° F. below freezing for two years was in perfect condition when removed, but quickly fermented at room temperature after removal from storage. Recent observations in a 50° F. chamber show that honey may also be stored at that temperature without danger of spoilage.

An examination of several warehouses shows that the temperatures of the rooms in which honey is commonly stored range from 55° to 70° F., and therefore provide ideal conditions for spoilage by fermentation. As most of this honey is bought in the late fall and winter, the danger of loss from fermentation can be greatly reduced by storage in unheated rooms, subject to outside temperatures.

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CONFECTIONERY FLAVOURING

By Harold Morgan, M.Sc.

The author gives his advice on the choice of flavours for confectionery, and discusses the practical considerations involved.

THE CLASSIFICATION of flavours into natural, compound and synthetic has already been mentioned in my previous notes on beverage flavours. Here again must be emphasised the importance of the correct use of suitable flavours. A new sweetmeat of interesting texture, attractively presented, and marketed with all the resources of an efficient and up-to-date sales force, can, for no apparent reason, prove to be a failure. How often is this due to sufficient attention not having been paid to the flavouring of the new line—combined with a careful study of the type of flavour that appeals to the public?

Only recently a case was brought to my notice of a line with a most attractive texture, and capable of being packaged with a really good sales appeal. But its sales were limited, and investigation soon showed that the sweetmeat had a definite after-taste which ruined all chances of popularity among the general consuming public.

The public taste changes. This must be admitted, but there are certain flavours or effects on taste which will never be popular in this country. On the other hand, despite changing tastes, a few flavours such as peppermint, lemon, etc., never become unpopular. It is worth while the confectioner noting carefully what particular flavours appear to be in demand by the public, and especially those which are popular in other food industries. For instance, the popularity of grapefruit beverages has enabled certain wideawake manufacturers to introduce sweets containing grapefruit oil.

From the practical point of view, several additional factors have to be borne in mind when considering the type, qualities, and actual handling of flavours. The outstanding point which first comes to mind is the question of temperature. Then there is the consideration of the type of flavour suitable for the goods, the quantity necessary and the manner in which the flavour can be incorporated without in any way affecting its distinctive taste and aroma. The latter is important, because there is a close relationship between the sense of taste and the sense of smell. The sense of colour perception is also involved, but a discussion on colouring is outside the scope of these notes.

The quantities of flavour required in various lines can be roughly grouped according to certain characteristics common to various manufacturing processes. Jellies and goods with a more or less neutral background do not require large additions of flavour, and those of lower strengths are quite suitable. High boiled goods, for various reasons, require strong flavouring. Owing to the high temperature of the boiling a certain amount will evaporate. The hard sugar dissolves slowly in the mouth, and so the flavour must be strong enough to last to the end.

Creams and fondants require fairly small additions or lower strength flavours. With chocolate centres the flavour must be sufficiently strong so as not to be masked by the covering. The amount will vary also according as to whether a bitter or sweet *couverture* is employed.

Consideration of the most suitable stage at which to add flavour involves a knowledge of the flavour itself, its reaction to temperature, and a thorough understanding of the technical side of manufacturing confectionery.

No particular difficulty arises in the case of fondants and creams, whether crystallised or chocolate coated. An allowance must be made for any possible evaporation during the drying out stage, and this is particularly applicable to the more volatile constituents of flavour.

The chief difficulty occurs with the high boiled goods. I doubt if any flavour can stand the high temperatures reached in the sugar boiling process. Obviously in the case of these lines the flavour must be added at the lowest possible working temperature. For clear goods the flavourings have to be added direct to the boilings in the pan to prevent any possibility of clouding or graining. A considerable loss results, and this must be allowed for in the dose. With other lines it is desirable to add flavouring ingredients to the boilings on the slab, and then as late as possible in order to take full advantage of the lowering in temperature.

Modern mass production methods have further complicated this question of addition of flavour. With small batches it was easy to work thoroughly the flavour into the batch on the cooling table with comparatively little loss, but nowadays boilings are so large that it is impossible to amalgamate the flavour except in the pan.

Many attempts have been made to minimise these flavour losses, and experiments are still going on. Fat-soluble flavours are on the market, and while these are a definite step in the right direction, considerably more work has yet to be done to discover suitable oil-soluble synthetics which can be blended to give more true-to-type results.

Natural flavours, from the point of view of taste, are undoubtedly the best. This is to be expected, as they are derived from the real fruit or other natural product. Their use in confectionery, however, is limited. High temperatures absolutely ruin many very fine fruit extracts — *e.g.*, raspberry, strawberry, blackberry, etc. These flavours are eminently suitable for lower temperature processed goods, such as creams, fondant chocolate centres, etc. To obtain the full value of the fruit extracts, attention must be paid to reproducing as far as possible the conditions under which they exist in nature —*i.e.*, the degree of acidity — bearing in mind that confectionery consists of sweet materials. A suitable background is important, and full consideration must be given to the matter in order to obtain a really satisfactory result.

Acids can be worked into high boils more effectively than into creams and suchlike confections. It is unfortunate that the true fruit flavours will not stand up to these temperatures. Compound flavours are blended with a view to overcoming the difficulty. In these certain chemicals are added to the natural product base in order to supply any deficiencies resulting from heat evaporation. This method of fortification serves a useful purpose. Wholly synthetic flavours are extensively used for high boils, and at present they appear to offer the only satisfactory solution. The blending of the chemicals forming these synthetics is a real art, combined with a thorough knowledge of the materials available. The latter are constantly increasing, and as time goes on synthetic flavours will improve and possibly lose that "chemical" taste which can often be detected, particularly in the cheaper samples. The production of new chemicals also offers possibilities of blending entirely new tastes in flavours, and this will be much appreciated by the manufacturer who is always on the look-out for "something different."

The solubility of flavours—in the strict sense of the word—is not so important in the case of confectionery as it is in their use in the beverage industry. They must, however, work in easily. The essential oils are employed in all classes of confectionery. Rectified spirit is the best solvent for flavouring materials, but for high boiled goods it is hardly necessary to spend the cost of the spirit duty when it all evaporates on being added to the boiling. With goods processed at lower temperatures, the taste of the solvent is important and should be carefully checked.

The question of the taste factor must be carefully studied. The art of blending is to produce a pleasing flavour whatever the type may be. Overflavouring must be avoided. Vanilla, or rather its more powerful synthetic substitute vanillin, is an example of a flavour which often is too pronounced. Too much flavouring in time cloys the appreciation of the delicate and more subtle constituents.

Flavour plays a great part in the assimilation of foodstuffs. A palatable food is more easily digested, the appetite is stimulated, and the foodstuff relished. All this stresses the necessity for more attention to the art of flavouring confectionery. The result will be, highly satisfied sweet consumers and greater output, to the delight of the manufacturer.

"Sirloin!"—Charles II conferring a knighthood on the popular loin of beef.

Refined Oils and Fats

Some observations on an article by T. G. Joyce, B.Sc., F.I.C., which we published in the last issue.

Professor T. P. Hilditch, University of Liverpool

I agree with the author's general theses that the refining of a fresh fat, and of one which has become altered by rancidity or retrogressive changes, represent quite different problems, that the "refining" of such rancid oils and fats very rarely, if ever, gives a product equivalent to that from a refined crude oil of good quality, and that the terms "refining" or "refined" should, strictly speaking, be reserved for the processes applied to, and the products obtained from, raw material of good quality.

Mr. Joyce, however, rather makes it appear that the processes of neutralisation, decolorisation, and deodorisation are used in order to remove products of decomposition from stale or rancid oils and fats, whereas these processes are those which are employed, in the case of a perfectly good crude fat, in order respectively to remove free natural acids, undesired colour, and undesired odoriferous or flavoured products from the fats. It is true that these processes also sometimes involve the removal or destruction of accessory factors such as vitamins, but if the public demand a colourless fat, and carotenoid or similar pigments have therefore to be removed, it is impossible to avoid the concurrent removal of some of the related vitamins. The same reasoning applies to the concurrent removal of antioxidant substances which, if left in the fats, would exert preservative action against oxidation without appreciably affecting the appearance or palatability of the product. In any case, with any vegetable fat (however fresh) it is imperative, in order to produce a palatable material, to remove both free natural fatty acids and odoriferous matter—that is, at least to neutralise and to deodorise.

When properly carried out, such processes do not in any way injure the purity or value of the material, which is "refined" in the true sense. If valuable accessory factors (vitamins) are removed in the process of purification, they can subsequently be added by means of a concentrate or by the incorporation of suitable animal fats which contain them and which do not require neutralisation or deodorisation.

The reintroduction of a suitable antioxidant, as Mr. Joyce indicates, is a more difficult matter at present, although considerable progress is likely to be made in this field in the near future.

I would like to suggest that the references to the names of two groups of workers in Mr. Joyce's last paragraph should be replaced by a general statement from which names are withheld, since there are a number of other equally active workers in both fields; for example, Holm and Greenbank, and Mattill, on antioxidants (in America), and Lea on light action and rancidity (in this country), to quote only a few. It might, therefore, be more fair to eliminate these, the only specific investigators referred to in the whole article.

G. R. Greenbank, U.S. Dept. Agriculture

I appreciate the opportunity to review this article, and shall be glad to hear from you again if I can be of any further assistance.

The author is correct in his statement that you cannot refine a poor oil and make a good oil. I cannot agree with him, however, on the general statement that darkening in colour accompanies oxidation. In most cases, such as butter, cottonseed, and corn oil, there is a bleaching action probably due to oxidation of the pigment carotene. The article is of value because it advocates the selection of high-grade oils before refining.

[Reference for further data on oxidation should be made to two recent papers by Greenbank and Holm—viz., "Photochemical Oxidation of Cottonseed Oil," *Ind. Eng. Chem.*, February, 1933, p. 167, and "Antioxidants for Fats and Oils," *Ind. Eng. Chem.*, March, 1934, p. 243. In the former it was shown, as the result of studying the relative accelerating effect of light of different parts of the visible spectrum upon the autoxidation of cottonseed oil, that the greatest accelerating effect lies in the range of the orange band, while the blue range is the least effective. In the second paper it is shown that the lipochromes present in oils and fats accelerate oxidation of glycerides. Quercetin, on the other hand, seems to possess antioxidative properties. The excellent keeping quality of raw vegetable oils is thought to be due to the natural antioxidants that are present in the raw oil but are destroyed or removed in the refining process. An unsuccessful attempt was made to isolate an antioxidant from cottonseed. Of the various extracts prepared, only the water-soluble less the heat-coagulable protein fraction showed protective properties. Experiments were made on the effects of adding various antioxidants to cottonseed oils and also other oils. Of those tried, maleic acid was found to be the most potent antioxidant. It is a surprising, as well as an important fact from the standpoint of an explanation of the mechanism of action of antioxidants, that fumaric acid, the isomer of maleic acid, does not act as an antioxidant of the phenols; only the *ortho* and *para* types are active as antioxidants for fats and oils. No doubt other research workers will now take up this important study of natural antioxidants and also

look into the possibilities of discovering or synthesising bodies more potent even than maleic acid.—EDITOR.]

The Author's Reply

I welcome the criticisms of such eminent men as Professor T. P. Hilditch and G. R. Greenbank on my note on the subject of Refined Oils and Fats. With regard to Professor Hilditch's remarks relative to the refining of perfectly good crude fat, I quite agree, provided that the process be absolutely confined to one of that description. Even in this case, however, as he points out, in order to satisfy the public demand, it is impossible to prevent loss of vitamins and antioxidant substances. This may explain, to some extent, why certain oils that, for the reason stated above, have been so treated, are very difficult to keep free from rancidity for any length of time. It would appear, therefore, that the processes for refining fresh oils, in use at the present time, are not altogether satisfactory.

With reference to the names of workers in the various fields in connection with oils and fats, I must apologise sincerely for having omitted those he mentions. This was purely an oversight. The value of their work is so well recognised that this must be my excuse for the omission.

Replying to the remarks of G. R. Greenbank as to darkening in colour accompanying the oxidation, I agree that this may not be always perceptible, especially where an oil is rich in carotene. In this case the bleaching action may be greater than the concurrent darkening and may therefore mask it. Two examples may, however, be given—the intensification of the colour of oleic acid on exposure to air, and the difference in colour between raw and boiled linseed oil.

ICE CREAM POWDERS (Continued from page 200.)

followed. These mixes may be homogenised or emulsified with the usual beneficial results as for ordinary mixes.

Care should be taken that, whatever the richness of the finished ice-cream, a balanced mix is used. If too high a proportion of milk solids not fat be used—say, by the addition of extra milk powder—then there is a danger of "sandiness" developing in the finished ice-cream owing to the crystallisation of lactose. If the serum solids exceed 12 per cent. in the mix, there is a great danger of "sandiness" developing. A "buttery" texture is caused by having too high a proportion of butter fat with regard to the total solids content. If 1¾ lb. of the powder according to the formula given above be used with 3 quarts of milk and 1 quart of cream (50 per cent.), then the resultant ice-cream would analyse approximately

Butter fat	10·1 per cent.
Milk solids not fat ..	9 ,,
Total solids	33 ,,

which is necessarily well balanced, and should store quite satisfactorily.

Boiled Mix Powders

A class of ice-cream powders which still enjoys a certain popularity, especially in Cornwall, South Wales, and the North of England, is a poor imitation of the "Italian" ice-cream. These powders are mainly farinaceous, cornflour, arrowroot, and the like, flavoured and coloured but unsweetened. It is necessary to boil the mix, as when making a custard. Usually 6 oz. are used per gallon of mix, which may be sweetened to taste. As gelatin is used as a rule as the colloid, and is often incorporated with the powder, great care has to be taken in the heating process, for gelatin is apt to give off an unpleasant odour if heated for long. A gelatin solution should not, of course, ever be allowed to boil, but in this case it is unavoidable in the proper making of the custard. The resultant ice-cream is not so palatable, not so health-giving, nor made so easily as the product from a good cold mix ice-cream powder, properly made.

CLARIFYING JUICE

ONE of our readers has furnished the following valuable comments in connection with Enquiry No. 1,549, on page 145 of the April issue. The questions were:

(1) Syrup used in preserving peel and cherries, on boiling in an open pan, becomes dark due to caramelisation. Will charcoal or chalk, etc., clarify it to any extent?

(2) Can you advise any particular filter to use with light syrups (about 20° Baumé) which contain particles of pulp from lemon and orange peel?

Our correspondent says: "If I were answering the queries (1) and (2) in this enquiry, I should group them together as follows: 20° Bé. syrup which has become dark in colour after use in preserving peel and cherries can be decolorised by the addition of from 1 to 2 per cent. of a high quality decolorising carbon. This carbon will also act as a filter aid, and very materially help the filtration of the particles of pulp to which you make reference. 20° Bé. syrup at 100° to 120° F. will filter most readily through an ordinary plate and frame press. The size of the plate and frame press, of course, depends entirely upon the volume of juice to be filtered, and these presses can be obtained with press plates having an available filtering area varying from 1 sq. foot to 16 sq. feet per plate, from any of the numerous sugar machinery manufacturers.

In the choice of a decolorising carbon for this purpose, care should be taken that the carbon is low in acidity in order to avoid over-inversion, and it must, of course, be of high decolorising value. It is advisable, in order to get the best value out of the carbon, to allow contact between the carbon and the syrup for about 20 minutes. This can be arranged by thoroughly mixing the carbon and syrup and then allowing a period of pause for the time mentioned, after which the syrup should be heated quickly to between 100° and 120° F., and passed through the filter press, either by means of a pump or a positive head. The first runnings of liquor should be returned to the source, because until the filter bags are somewhat precoated with carbon it is possible that some of the more finely divided particles of carbon will find their way into the syrup.

The use of good quality decolorising carbon has the added advantage of removing to a very large degree the organisms that have found their way into the syrup, which organisms are usually air-borne, and developed by stagnation due to the nature of the process."

Industrial News

ENGLISH FARINA AND DEXTRIN—FRUIT STORAGE—LEICESTER CANNING EXHIBITION—ESSENCES AND SUNDRIES—CAN-CANS CAR RALLY—BIOLOGY OF REFRIGERATION—SPIRAL TUBE-WINDING EQUIPMENT

English Farina and Dextrin

This country uses approximately 125,000 tons of farina and dextrin annually, but has been obliged hitherto to import the whole of it from the Continent. Consequently there is intense interest in the Isle of Ely in the project, now practically complete, to erect, equip, and operate mills near March to manufacture and market these two products, which are directly derived from potatoes.

The plant, to cost about £120,000, is designed for an output of 14,500 tons of dextrin; 5 tons of potatoes make 1 ton of farina, yielding nearly 19¼ cwts. of dextrin, so that about 75,000 tons of potatoes will be required per annum. Farina is used extensively in the production of confectionery, cake mixtures, etc., while dextrin finds wide application in the textile trades, and in the manufacture of adhesives for labels. Bookbinders, papermakers, and carton manufacturers are also very large customers.

The company formed—British Farina and Dextrine Company, Limited, 109, Kingsway, W.C. 2—will have a public issue this month, and the project should be of interest to investors.

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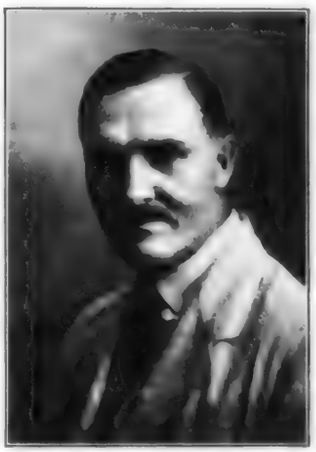
International Bakers' Exhibition

The third annual International Bakers' Exhibition will be held this year at the Institut International de Boulangerie, 25, rue Major René Dubreucq, Brussels, from June 3 to July 15.

This year's show will be on a much larger scale than before, and will include sections for Bread (with a cup for the best exhibit), Pastry, Biscuits, Confectionery, and Chocolate. Technical books and periodicals dealing with these industries will be shown.



This is a picture of Mr. A. A. Maytham, British representative of Dewey and Almy, Ltd., manufacturers of Darex and Gold Seal Products, who sailed on May 4 for U.S.A. He is expected back in London at the beginning of July. Mr. Maytham will visit the parent company and make a tour of laboratories and works in order to take stock of all new developments. Special interest is attached to certain new developments in connection with glass packing.

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Electrical Plant

We have received a catalogue of new and second-hand electrical plant from Messrs. George Cohen, Sons and Co., Ltd., 600, Commercial Road, London, E. 14.

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The Leipzig Fair

The Leipzig International Industries Autumn Fair will take place at Leipzig from August 26 to 30.

Fruit Storage

Apples and other fruit, if stored in a closed chamber, soon suffer deterioration owing to the increase in the CO_2 content of the atmosphere by the respiration of the fruits themselves.

By an ingenious adaptation, disused hop kilns, which are common in fruit-growing districts, may be made suitable for fruit storage. The kilns are made gas-tight by lining with vaseline-covered galvanised sheets; a circular duct passes up the centre, having at its lower end an evaporator coil and at its upper end a fan to circulate the cooled air around the fruit cases. Apples are wrapped in oiled paper and stored at any desired CO_2 concentration according to condition (8 per cent. CO_2 is usual). The proportion of CO_2, oxygen and nitrogen may be controlled by automatic ventilation.

Our illustration shows a model of one of these converted kilns.

Leicester Canning Exhibition

The Leicester Town Council is rendering great assistance in the matter of publicity for the Canners' and Allied Trades' Exhibition at the Granby Halls, Leicester, next November.

The exhibition was last held in Leicester in 1930, when the attendance—80,000—constituted a record. This year the large populations of Derby and Nottingham are to be included in the publicity programme, and the trade associations will be mobilised in order to ensure the presence of the maximum number of retailers. It is expected that all previous records will be broken.

The Annual Convention will again be held during the exhibition, so that opportunities will be afforded to the suppliers of canners' requirements of bringing their products before the principals of the canning firms. Features of special interest to the public will be staged in order to increase interest in canned goods.

Leonard Hill, Ltd. will be represented at the exhibition as in the past. FOOD MANUFACTURE and its associated journal, *Food Industries Weekly*, have reserved 160 square feet of space, and will occupy a prominent, pleasantly situated corner stand facing the garden. Readers are invited to meet here when they visit the exhibition.

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Essences and Sundries

A new list of products supplied by Messrs. A. Boake, Roberts and Co., Ltd., includes, among many others, soluble essences of lemon and ginger, special soluble essences for mineral waters, for fruit wines and cordials, and for liqueurs and cocktails; also concentrated essences for flavouring confectionery and biscuits, essences for jellies and ice-cream, harmless food colouring materials, essential oils, and chemicals and sundries. "Aero Heading," a highly concentrated liquid heading, is claimed to give a close creamy and lasting foam on every kind of brewed goods, mineral waters, etc.

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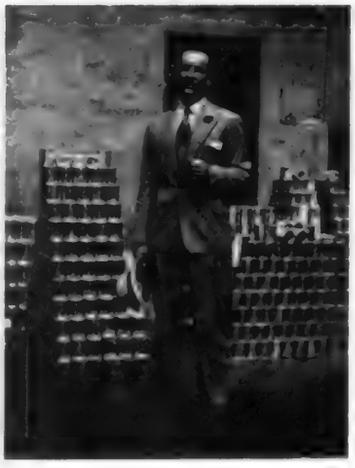
Can-Cans Car Rally

There will be a Motor-Car Rally at Ferring-on-Sea on Saturday, July 7. The meeting place is the Ferring Grange Hotel, Ferring-on-Sea, near Worthing; lunch at 12.30. Details of route, etc., will be available in due course.

Chancellor Leonard Hill has kindly issued an invitation to tea at his house at Ferring.

Bathing, golf, tennis, putting, darts, billiards, table tennis, deck tennis, and bridge are among the attractions provided.



This photograph introduces Dr. Damazy Jerzy Tilgner, a leading food specialist of Poland.

After extensive studies in agricultural technology at the University of Poznan, he obtained his Master's degree for a treatise on pectins.

He worked in several Polish canning and food plants, and later on went to the United States, where he was connected with many leading American food concerns, including Armour and Co., Libby, McNeill and Libby, California Packing Corporation, working exclusively in canning plants.

For a short time he was also with the research staff of the Fruit Products Laboratory of the University of California in Berkeley, investigating problems connected with frozen food.

After his return to Europe in 1930 he was in charge of the development of a large canning concern in Central Germany. Returning after a few years to Poland, he finished his Doctor's thesis dealing with special food problems; for this he was awarded a silver medal by the University of Poznan. Dr. Tilgner is at present connected with the Polish Ministry of Commerce and Trade, and he is an important figure in the Polish canning industry. He is the author of a number of books on food in Polish, German, and French.

In spite of his varied activities he still finds time to be an active sportsman, being well known as a very experienced and successful oarsman.

Biology of Refrigeration

At the request of the President of the British Association of Refrigeration, arrangements have been made for a second refresher course of lectures on the Biological Aspects of Refrigeration and other Methods of Food Preservation, to be held at the Low Temperature Research Station, Cambridge, for one week, beginning July 23. Details of the lectures to be given will be forthcoming later. A fee of 30s. will be charged for the whole course to cover expenses. Owing to lack of accommodation the numbers will be limited to thirty; those wishing to attend the course, therefore, should notify Mr. J. Raymond, Honorary Secretary of the British Association of Refrigeration, Empire House, St. Martin's le Grand, London, E.C. 1, as soon as possible.

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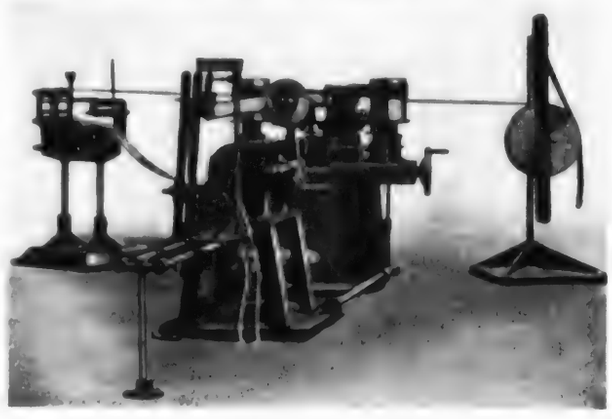
Spiral Tube-Winding Equipment

Messrs. Perkin and Co., Ltd., of Lord Street, Whitehall Road, Leeds, 12, send us an interesting brochure descriptive of their spiral tube-winding machine, which is designed for the production of paper, fibre, or strawboard tube of any length, in diameter between 1 and 6 inches. These tubes, of two, three, or a larger number of plies, are subsequently employed as the bodies of paper or fibre containers, reels for twine, wrapping paper, etc.

Additional machines required in the production of containers are a tube-cutting machine and a press for making ends, and if these are to be of tin, a curling machine to curl the edges of the tin stampings, and a bottom-seaming machine. A complete lay-out is capable of an output of 5,000 to 15,000 containers per day. These figures may be increased by duplicating the supplementary machines, as the spiral tube-winder has a larger output than these.

Our illustration gives the machine in end view, with the arrangement of the automatic cut-off.



INFORMATION and ADVICE

Fish Pastes — Tinned Galantines — Potted Tongue Paste—Liquid Coal Gas—Worcestershire Sauce — Peanuts — Dripping — Pickles — Lemonade Crystals — Custard Powder — Mayonnaise—Artificial Cream—Tonic Food —Vanilla Essence—Rancidity of Dried Milk

Fish Pastes

1,582. *Kindly furnish me with a recipe for an ordinary salmon shrimp paste, and also bloater paste.* (London.)

Reference should be made to an article which we published in the June, 1932 issue on this subject. Recipes can only serve as a guide. The choice of ingredients is a matter which is largely governed by considerations of price, type of market, and so on. It rests with yourself to develop your own recipe. For salmon and shrimp paste the base might consist of, say, 50 lb. salmon, 12 lb. bacon fat, and 10 lb. shrimps (skinned). The quantities of seasoning, including sugar, you would have to work out yourself according to your particular requirements in the matter of taste. You might use about 4 oz. of sugar, and as seasonings you could use white pepper, cayenne, and ground mace.

For bloater paste you could use red herrings, bacon fat, colouring matter, and "smoke powder," or you might use for the base 24 lb. bloaters, 16 lb. bacon fat, 12 lb. salmon, 12 lb. anchovies, and 4 lb. rice flour. For a high-class product you might add butter. Then for flavouring you could use pepper and nutmeg.

The ingredients are minced and well mixed. The paste is filled into pots (this must be done carefully to avoid inclusion of air, and pots should be filled to the top). The caps are rolled on, and the jars sterilised at 230° to 240° F. for 30 to 40 minutes in the case of 3-oz. jars. Larger jars will require longer time. If a retort is not available, stack the containers in a tank, fill up with cold water, and gently heat to 180° F. for an hour. Bring to boil in half an hour and hold there for 15 minutes. Cover the tank with sacks, and run off the water.

1,583. *We note in your May issue, page 181, that you mention Messrs. International Pulverisers, Ltd. We should be obliged if you could supply us with their address, as we should like to see their catalogue.* (Edinburgh.)

This was done.

1,584. *Some time ago you published in your journal an article concerning the making of mayonnaise sauce. We should be glad if you would let us have a copy of the number containing this article, if it is still procurable.*

Can you supply us with any information regarding the use of mustard oil as a preservative agent? (London.)

As regards mustard oil, we published an article by Dr. Corran on its emulsifying and preservative properties. Dr. Corran has also written another paper on its preservative properties, and he would no doubt be glad to furnish you with a copy.

Tinned Galantines

1,585. *We are making 3-lb. tins (7 in. long by 4 in. diameter) of meat, ham and tongue galantine, wheeling on the lids. The meat is cooked before it is put into the tins. We shall be glad to know if they should be retorted, and how long and at what pressure; should they be vented in any way? We do not use a vacuum wheeling machine.*

Can you tell us also the time for 1-lb. tins wheeled on?

Also let us know the time to retort 1-lb. glasses (automatic closure) of the same material. (Scotland.)

The procedure need not differ materially from that employed in the case of meat pastes, where 30 to 40 minutes' retorting at 230° to 240° F. should be given in the case of 3-oz. glass jars. Larger jars will require a longer treatment, best determined by actual experiment. For general information you are advised to consult the meat products section of the *Food Industries Manual*. In the case of tins, the 1-lb. size might require about 60 minutes at 240° F., and the 3-lb. size 90 to 120 minutes at the same temperature.

The usual practice is to fill the cooked galantine cold into tins in the same way as is customary for meat pastes, taking care to avoid entrapping air and to fill well up. The next step is to vacuumise. This may be done successfully by carefully extracting the air by means of a vacuum machine, followed by seaming on the lid. The other way is to heat and exhaust the tin in the usual manner, placing the lid loosely in position while in the exhaust box, and then double-seaming while hot; alternatively the cap and hole method may be used. Finally, the tins are retorted as indicated above. Of course, the time of retorting will be influenced by the method or exhausting adopted—viz., whether heat-exhausted or mechanically exhausted in the cold. The actual time can only be definitely settled by experiment,

inserting a thermometer at the centre of a can and finding how long it takes to attain approximately the retort temperature. In any case, in everyday practice, every batch treated should be under control as regards temperature of retort and at the centre of the can.

Potted Tongue Paste

1,586. *Kindly supply a recipe for a potted tongue of the paste type.* (London.)

The following is a suggestion:

Boiled tongue	2 lb.
Corned beef	3 ,,
Boiled bacon	1 ,,
Butter or margarine	1 ,,
Black Pepper	1 oz.
Pimento	¼ ,,
Cayenne	¼ ,,
Salt	to taste

All meat for this purpose must be well boiled and the bones removed.

The meat must be reduced to as fine a paste as possible, and the seasoning added gradually during the chopping, so as to be well mixed with the meat. Colour with rose-pink if necessary. Fill into dishes and cover with melted butter or margarine.

Liquid Coal Gas

1,587. *Kindly give information as to how coal gas may be liquefied and also solidified.* (Malta.)

Since coal gas consists of a number of different gases, including hydrogen, it will be necessary to employ temperatures and pressures required to liquefy the most resistant—namely, hydrogen. The enquirer was put in touch with a firm able to supply plant for the purpose. A small machine able to turn out about one gallon an hour would cost about £90. The difficulty is the storage of the liquid. This could not be done in steel cylinders; one would have to employ the Dewar flask, which means that it is not a commercial proposition; neither is solid coal gas.

Worcestershire Sauce

1,588. *Can you advise me as to the correct method of manufacturing Worcestershire sauce? Also please supply a recipe for salad cream.* (Glasgow.)

In answer to your question about the correct manipulation of Worcestershire sauce, I am afraid that it would be impossible to put this down on paper as it is not an exact science but an art, which depends on the experience of the cook. One can only give the general principles, which were discussed in an article on sauce making, published in the March, 1933, issue of FOOD MANUFACTURE.

Worcestershire sauce is one of the most difficult products that can be tackled, as so much depends on the delicate art of manipulation, and it is obvious that no definite directions can be given in this matter. Any recipe and instructions can only be taken as a guide. Much also depends on the purchase of the ingredients, particularly the spices, which show wide variations in quality and flavour.

Considerable experience is necessary in the choice and blending of spices, which are purchased in a ground condition, and previous to use are made into a thin paste with water and allowed to soak for 48 hours. The onions and garlic, previously peeled, and the limes, lemons, raisins, preserved ginger, etc., are chopped very fine in a mincing machine or meat chopper. Tamarinds should be boiled and passed through a pulping machine to remove stalks and stones.

If gum tragacanth is used, it should be soaked in water for 48 hours and then passed through a fine sieve. The ingredients are simmered for about an hour in a steam pan, preferably stainless steel, certainly not copper, and preferably not iron. They should then be passed through a flat stone mill, followed by a fine sieve. The bottles are filled from a vat, fitted with a stirrer.

The enquirer was furnished with a recipe for salad cream.

Peanuts

1,589. *As a reader of your esteemed journal, may I ask you for any method of blanching peanuts in such a way as to prevent their breakage?*

At present, by cooking and drying, too much breaking occurs in the blanching machine.

Any process or information regarding same will be appreciated. (Lancashire.)

I should be glad to have some particulars about the machine you are using. It is usual to pass the cooled nuts through machines of special design which are equipped with brushes revolving against corrugated plates.

Dripping

1,590. *We should be glad if you could let us have some information on the manufacture of Dripping.* (Ireland.)

Cut up fine (or pass through mincer fitted with $\frac{3}{5\frac{1}{2}}$ in. plate) the fat, taking care that it is all clean and sweet. Place in a clean boiler, starting the cooking with a small quantity of dripping obtained from a previous rendering in order to prevent burning. Bring to boil and stir frequently. When the cracklings have become crisp, remove them as rapidly as possible, and put them through a large press, and strain the liquid through a fine sieve or muslin. Constant care should be taken to prevent burning.

One way of "refining" the dripping is to melt it, taking care that the boiler is not more than two-thirds full. Add water and salt (1 lb. salt to 2½ gal. of water), and stir continuously until 200° F. is reached. Then treat with fuller's earth or other "refiner"; stir, simmer, skim, turn off steam, settle and strain through fine muslin.

1,591. *Kindly refer us to literature on manufacture of margarine and edible fats.* (Newcastle-on-Tyne.)

This was done.

Pickles

1,592. *We are very much obliged for your letter of yesterday's date, giving required information re "Branston Type Pickle." This is of considerable interest to us. On reading through the contents the following general points occurred to us, and if you could see your way clear to give us further information we should be indebted to you.*

(1) *Why is gum tragacanth invariably used as a thickening agent for all manner of sauces and pickles; what advantage does it have over such agents as cornflour, farina, wheat flour, etc.?*

(2) *Where sauces are used in conjunction with vegetables, etc., as in the case of some pickles, piccalilli and the like, is it better to let the sauce cool before putting it in the jars and then adding the vegetables, or is it better to fill hot? As sauces alone are usually filled hot, we wonder why it is that cold filling is sometimes stipulated, generally speaking for the products concerned in this class of manufacturing. Is cold filling the same as hot; at least, are the results the same? Phœnix style capping we have in mind.*

(3) *With regard to your last remark in your letter of April 16, 1934, in the case of better-class pickles of the Branston type. Do we understand that these are usually made by cutting up vegetables or fruits, such as mangoes, that are bought in syrup, and simply added to (packed in) a good ordinary commercial tomato sauce? What sweet pickled vegetables have you in mind?* (Scotland.)

The reason why gum tragacanth is used is that it possesses greater thickening power, weight for weight, than cereal flours; that is to say, the solid particle ingredients of the sauce are less liable to settle out and are held better in suspension by the use of gum tragacanth. Further, in the use of cereal flours, it is difficult to avoid formation of lumps, and it is difficult to obtain a flour paste perfectly uniform and free from all lumpy matter. The function of both gums and flours is to act as a thickening medium, through which the solid particles of sauce are uniformly dispersed and held in suspension.

With regard to your second enquiry, the liquor should be allowed to cool before filling into the jars for piccalilli making, although your question is not clear.

There is no reason why they should not be filled cold, provided that the bottles and the caps are in a perfectly sterile condition. Filling, of course, should be done from a vat which has also been previously sterilised, and which is fitted with a stirrer so as to keep the sauces in uniform suspension throughout.

The main point to observe is that there is no chance of any infection. So long as the filling is done under perfectly sterile conditions, I do not see any particular reason for filling hot, as in most sauces the content of spices and acetic acid is so high as to make it difficult for any infection to prove fertile, but, still, one wants to take no chances. With tomato sauce it is different, as here there is a distinct danger of spoilage, and tomato sauce should certainly be sterilised in the bottles after capping.

With regard to question 3, I do not know that I have in mind any particular type of sweet pickle. I was referring to vegetables put up in a sweet spiced vinegar, a recipe for which can be supplied if required.

Lemonade Crystals

1,593. *Kindly give us your advice on the production of lemonade crystals. With regard to the packing of free running salt, can you suggest what proportion of calcium phosphate should be added?* (England.)

One formula for lemonade crystals is:

Castor sugar	56 lb.
Citric acid	2½ ,,
Oil of lemon	8 oz.
Five per cent. solution of tartrazine in water	6 ,,

Rub the colour and lemon oil in a few pounds of the sugar, which should then be thoroughly mixed with the remainder of the sugar and the citric acid. The whole should be rubbed through a coarse sieve to break up lumps and disperse the colour and flavour throughout the mass. To avoid the mass becoming sticky it is advisable to let it stand in the open room for a few hours —overnight for preference—before packing. A freer-running product is said to be obtained if 15 to 25 per cent. of the sugar is replaced with cerelose.

In the case of free-running salt, you might try adding about 2 per cent. of the phosphate. It is a question of finding by actual trial the minimum proportion needed to give the desired results, as the exact amount will vary according to the moisture content and certain physical properties of the particular batch of salt under treatment.

Custard Powder

1,594. *Please supply a recipe for custard powder.* (Lancashire.)

I would refer you to the answer given to Enquirer No. 1,552 in the April issue.

1,595. *Please supply information concerning methods of processing vegetables and meats in glass.* (Sussex.)

I am afraid that this is too large a subject to be dealt with by correspondence, as details of the processes to be followed, especially times and temperatures, and also the particular method of pre-treatment of the products, will depend on just what vegetables or meat you are putting up.

The best thing you can do is to consult the canning section of the *Food Industries Manual*, in which you will find information under the headings of the various products.

If you will inform me just what vegetables and meats you are going to treat, I shall, no doubt, be able to give you some particulars.

1,596. *How are sweetened and unsweetened ice-cream powders manufactured? Kindly give me all details regarding the drying of fruits and the plant required.* (Norway.)

As regards ice-cream powder, consult the present issue, in which you will find an article on the subject.

With reference to the drying of fruits, this is also a very large subject, and there are many types of driers and methods of carrying out the operation. Of course, details depend also on the type of fruit being dried, and on the desired output and the amount of capital you are prepared to spend on the plant. By far your best plan is to submit your proposition to a firm of drying engineers.

Mayonnaise

1,597. *As readers of your journal we should be very much obliged to you if you could give us an advice in the following matter:*

We are producing mayonnaise, the surface of which is very quickly getting yellow-brown.

Could you perhaps give us your advice as to what chemical product has to be added to keep the mayonnaise staying white and not turning brown. (Germany.)

It would appear that your trouble is due to the fact that you are not obtaining a sufficiently high degree of emulsification, with the result that the oil phase rises to the surface and becomes oxidised.

Either your method of emulsifying is not correct or your ingredients are not correct. However, without knowing exactly what you are doing and what you are using, it is impossible to give you any definite advice in this matter.

Your best plan is to get a food chemist to examine one of your samples and to submit to him all the necessary information.

Artificial Cream

1,598. *Will you kindly give us a method of making synthetic (artificial) cream? We have heard that it is made of an emulsion of arachis oil in milk.* (Sweden.)

Obviously an homogeniser is required. Coconut oil would probably be better than arachis oil. Your best course is to secure the services of a technical man who has access to a homogeniser, so that he can make up a series of samples for your consideration.

Tonic Food

1,599. *We have an enquiry from India for a tonic food which does not consist of milk or casein. We understand our clients' customer has been using "Bemax" but wishes to make a change.*

We have made enquiries in several directions for a suitable product, but, as we have, so far, met with no success, we are wondering whether you can kindly assist us by suggestions as to likely manufacturers. (London.)

Personally I have no suggestions to make, but perhaps some reader would care to assist in the matter.

1,600. *We shall esteem it a favour if you will kindly send us a recipe for the manufacture of lemon curd for factory output.* (England.)

This was supplied.

1,601. *I shall be much obliged if you will give me any information on the manufacture of calves'-foot jelly and cheese rennet.* (Ireland.)

This information was supplied.

Vanilla Essence

1,602. *Kindly give recipe for a chocolate varnish. Also a formula for vanilla essence.* (Japan.)

Gum benzoin	30 per cent.
Alcohol	70 ,,

Powder the gum and add the alcohol. The mixture should be kept in a tightly closed vessel in a warm place. Agitate frequently until the gum is dissolved; then filter.

As regards vanilla essence, the following may serve as an example:

Vanillin	0·62
Coumarin	0·05
Alcohol, 95 per cent.	18·75
Glycerol	12·50
Syrup (U.S.P.)	12·50
Compound tincture of cudbear. ..	1·75
Distilled water sufficient to produce	100·00

Coumarin often is incorporated in these artificial essences, and has a flavour three times as strong as vanilla, but, of course, it is different in character.

Rancidity of Dried Milk

1,603. *After carefully studying the contents of the reports on the Rancidity of Dried Milk, published in the March issue of* FOOD MANUFACTURE, *it would seem that method* (b) *would be the most convenient to us. We are more interested in being able to detect the susceptibility to oxidation before this defect has been produced, rather than detect it in a faulty product. Method* (a) *appears to be very delicate, and the rapid extraction of fat with cold ether without previously dissolving the casein with a base or an acid, does not give results with dried milk obtained by pulverisation. In one and a half hours of contact, agitating occasionally, some whole dried milk will not give up more than 2 per cent. of its fat content; employing Soxhlet apparatus during six hours one does not obtain 10 per cent. of its fat content. It is to be understood that treating dried milk with 28 per cent. fat one obtains in the first case 0·56 per cent. and in the second 2·8 per cent.*

We should be very glad, in consequence, to have further details in connection with method (b). *Furthermore we should like to receive a copy of the article by Greenbank and Holm, "Jour. Ind. and Eng. Chem.," 17, 625 (1925). We understand this is published in the United States.*

On the other hand, we would be interested in the method by Issoglio, for determining the volatile products which reduce the permanganate of potassium obtained by distillation in a jet of steam from water, if it is possible to obtain information regarding its practical value and the condition of its execution. (South America.)

(*a*) *Determination of the Degree of Oxidation.*—In the March, 1934, issue it was stated that the extraction should be made using a hot extraction apparatus; in other words, extraction by a constantly renewed stream of boiling ether, and *not* by *cold* ether. Using this method with an extraction time of one hour, no difficulty whatever is experienced in obtaining 23 to 24 per cent. of fat from a dried milk of 28 per cent. total fat content; a proportion which is quite high enough for the purpose in view.

The following figures obtained from a fresh full-cream milk powder exposed to the winter sky (some sunshine at first) are given in illustration:

Exposure (Minutes).	*Odour and Flavour.*	*Peroxide-Oxygen Content of the Extracted Fat.*
0	Fresh, cream-like	1·00
15	Slight tallowy odour and after-taste	2·78
30	Odour and flavour more marked	3·74
60	Pronounced tallowy odour and	6·44
120	unpleasant tallowy after-taste	8·30

As indicated previously, direct determination of peroxide-oxygen on milk powder gives low results. In the present case, for example, the fresh material, and the 15, 30, and 60 minute samples all gave zero values, while the last sample gave only 0·35 c.c.—*i.e.*, 1·25 c.c. 0·002 N thiosulphate per gram of fat.

(*b*) *Determination of Susceptibility to Oxidation.*—The method referred to in the March issue is that due to Greenbank and Holm [*Ind. Eng. Chem.*, 17, 625 (1925)]. The apparatus and technique employed by Triebold and Bailey [*Cereal Chem.*, 9, 50 (1932)] for direct susceptibility determination on powdered crackers would probably be suitable also for dried milk. Alternatively this or any other of the tests might be carried out on the pure fat extracted with adequate precautions against oxidation during the process.

The Issoglio test has found some practical application with fats and oils of various kinds, and has also been used successfully in the form of Grethe and Newton's method for determination of susceptibility [*Oil and Fat Ind.*, 8, 291 (1931)], but I have not used the test with milk fat, and I am not prepared to say whether it will prove sufficiently sensitive to give useful results in this particular case. The test is carried out as follows: The fat (20 to 25 gm.) is weighed into a long-necked distilling flask, water (100 c.c.) added and distillation carried out in a current of steam, 100 c.c. of distillate being collected in 10 minutes. The mixed distillate (10 c.c.), distilled water (50 c.c.), 20 per cent. sulphuric acid (10 c.c.) and 0·01 N potassium permanganate solution are then heated to boiling and boiled for 5 minutes in a flask fitted with a ground-in condenser. After the flask has cooled somewhat, 0·01 N oxalic acid (50 c.c.) is introduced, and the contents titrated with 0·01 N permanganate. If X c.c. of the latter are used, and the volume required for a blank test in which the fat is replaced by 10 c.c. of distilled water is x, then the oxidisability number (the number of mgm. of oxygen necessary to oxidise the organic compounds removed by the distillation of 100 gm. of fat in a current of steam) will be given by the expression $80\ (X-x)/W$, where W is the weight of fat taken.

CREAM CHEESE

THE EDITOR,
"FOOD MANUFACTURE."

DEAR SIR,

Re your May number, page 185, "Cream Cheese." We note that you state, in answer to a query from Yorkshire, that there is no legal method by which a cream cheese can be guaranteed to keep fresh for three weeks.

We beg to state, as the only manufacturers in this country of a cream cheese which is guaranteed, and easily keeps for three weeks, that this is incorrect.

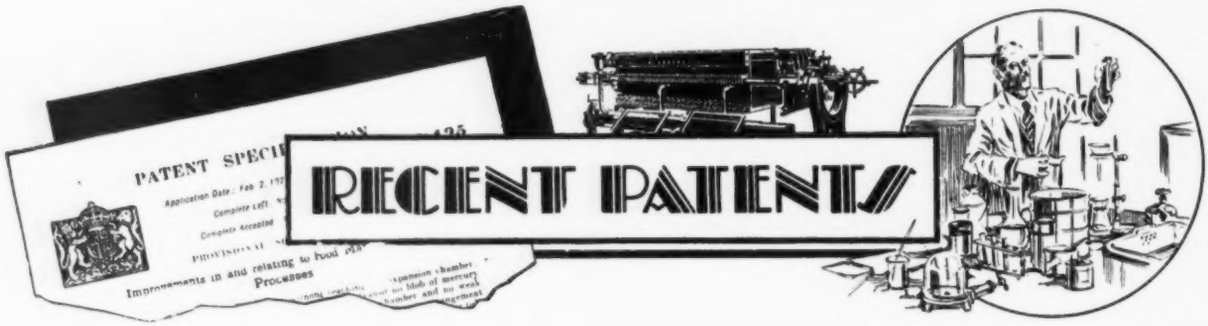
We would therefore ask you to print an apology to us, because we are prepared to have our cheese analysed to show that it is a Pure *Cream* Cheese, and we would add that it has been analysed by several public analysts in the biggest cities in the country, who have definitely stated that in every way our cream cheese is a *true* cream cheese.

We are also prepared to supply a cheese that will keep for three weeks, and which is guaranteed to contain no preservatives whatsoever.

We shall therefore be pleased to hear that you will rectify your very misleading information.

Yours faithfully,
COTTSLOWE DAIRY PRODUCTS, LTD.

We have received this letter from one of our readers, the Cottslowe Dairy Products, Ltd., of Aylesbury, Bucks, and we have, of course, much pleasure in publishing it for the benefit of all who are interested in the subject. This correspondence arose out of the views expressed by one of our contributors that he did not know of any method of making cream cheese which will enable it to keep fresh for three weeks, and that he did not know of any legal method by which a *cream* cheese can be guaranteed to keep fresh for three weeks. He did not, of course, imply that such an achievement was impossible, and indeed it is quite clear from out correspondent's letter and from what we have since ascertained that a true cream cheese which can be kept quite fresh for three weeks without the use of preservatives is being manufactured in this country by our correspondent. Needless to say, we are very glad to have this opportunity of bringing these facts to the attention of our readers, and extend to the Cottslowe Dairy Products, Ltd., the congratulations they so well merit.



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Latest Patent Applications

9754. Wanklyn, K. P.: Improving baking qualities of wheat, flour, etc. March 29.

9865. Peek Frean and Co., Ltd., and Rondolin, L.: Food, etc., cartons. March 29.

10157. Continental Can Co., Inc.: Preparation of spice products. April 4.

10241-10243. Elact Ges. fur Elektrische Apparate Ges.: Reducing acidity of dairy produce. April 4. (Austria, April 20, 1933.)

10552. Beattie, Ltd., W., and Muir, R. A.: Foodstuffs. April 7.

10664, Arnott, Ltd., W.: Packing biscuits, cakes, etc. April 9. (Australia, April 11, 1933.)

10685. Hanseatische Mühlenwerke Akt.-Ges.: Production of phosphatide preparations. April 9. (Germany, June 8, 1933.)

10727. Lemale, P. C.: Apparatus for concentrating fruit juices. April 9.

10894. Friedel, A. H.: Producing nutrient material for growth of yeast cells. April 11.

10910. Berczeller, L.: Extracting oils, fats, etc., from materials. April 11.

12221. Burleigh, A. S.: Machines for extracting oils from rind of citrus fruits. April 23.

12329. Nagle, J. C.: Packing invert sugar, etc. April 24.

Complete Specifications Accepted

407,959. Stucky, U. J. G., and Steiner, J. A.: Manufacture of fondant.

407,973. Imperial Chemical Industries, Ltd., and Hill, F.: Colouring foodstuffs.

408,050. Wilson, J. F. G., and Munro, Ltd., R. W.: Machinery for conveying, grading, sorting, and sizing produce or articles such as coal, fruit, and suchlike.

408,106. Wilhelm, K. F.: Method and means for preparing raw materials containing oil or like extractable substance.

408,327. Swift and Co.: Triangular prism-shaped containers or tins.

408,362. International Yeast Co., Ltd., Auden, H. A., and Eaglesfield, P.: Drying of yeast.

408,613. Gilbert, W. V. (Ornfeld, E. Orno-, and Loew, O. M.): Means for increasing the utility of coffee.

408,694. Hobbs, E. W.: Cartons, fancy boxes, and like containers for chocolate, sweets, and confectionery.

408,780. Reeves, G. N., and Vitacream, Ltd.: Cooling of liquid milk products and other liquids after heating.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

Abstracts of Recent Specifications

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per group volume, or in bound volumes price 2s. each.

Improved Flours containing Carob Seed Substance. An earlier patent (E.P. 385,796) covering a process for improving flours by incorporating milled products from the seeds of Ceratonia siliqua (carob plant) or related plants from the groups of the Mimosaceæ or Cæsalpiniaceæ is now supplemented by the discovery that still further advantages follow incorporation of the germinal substance flour or the germinal substance of the seed kernels itself from these groups of plants. In particular the dough-forming and bread-making qualities of the flours are improved.

Examples: (1) 0·5 to 5 kgm. of germinal substance flour of Ceratonia siliqua are well mixed with 100 kgm. wheat or rye flour and the mass converted to dough or baked by standard methods. (2) Similarly, 100 kgm. rice flour are worked up with 20 to 60 kgm. germinal substance flour of Ceratonia siliqua. (3) To manufacture aerated bread a gluten-rich mixed flour is first compounded from 700 parts wheat flour, 100 wheat gluten, and 100 germinal substance of Ceratonia siliqua (or an equal weight of gluten from the latter). This mass is incorporated with the other usual ingredients of dough. To avoid development of a green colour in the latter it is recommended to add 200 to 300 gm. citric acid per 100 kgm. mixed flour. The dough is aerated in the usual manner and passed through a pipe of suitable diameter, on issuing from which it is cut up into appropriate lengths, which should be baked without delay. (E.P. 407,231; Convention Date, Austria, May 19, 1932.)

It will be recalled that the preponderating protein content of the germinal substance from the carob tree seed kernels recently suggested its adoption in diabetic foods. (E.P. 404,677.)

De-bittering Process for Soya Flour. In place of the somewhat involved processes suggested in the past for eliminating the natural bitter flavour of the beans from soya flour it is now claimed that treatment of the beans with slightly acidulated water at a temperature not exceeding 75° C. is sufficient for this purpose.

Example: 10 kgm. shelled soya beans are successively left to soak for a few hours in the same weight of water containing one-tenth per cent. acid (acetic, phosphoric, hydrochloric, etc.), washed repeatedly with water, immersed for two hours in water maintained at 75° C., dried, and ground. After this de-bittering treatment the flour is passed on to a roaster in which the temperature is gradually increased until development of the desired flavour, when it is cooled forthwith. The mineral salt content of the flour can be increased if the first soaking water is acidulated with phosphoric acid and subsequently neutralised with lime before the washing and hot water treatments. (E.P. 407,866; Convention Date, Germany, July 20, 1932.)